THE

AMERICAN NATURALIST.

VOL. XIII. — *JANUARY*, 1879. — No. 1.

ON CERTAIN CONTRIVANCES FOR CROSS-FERTILIZATION IN FLOWERS.

BY PROF. J. E. TODD.

SINCE the first announcement of the principle of cross-fertilization, by Darwin, many most interesting and instructive examples have been noted and published, but the field is by no means exhausted.

Some ingenious contrivances for cross-fertilization are charmingly described by Prof. Gray in his little work "How Plants Behave," which he published a few years since as earnest of a larger work, which, we hope, may be soon forthcoming. One as wonderful as any is the Iris. His description applies nearly equally well to any species of that beautiful genus. His figure, perhaps, is open to slight criticism; the pistil is too erect and the stigma, therefore, too high above the sepal to illustrate its function to the best advantage. The position given is sometimes observed after the pistil is fertilized, but before that the pistil turns down so close to the sepal that a large bee in entering *must* touch the stigma with his back, which has been powdered with pollen while working in some previously visited flower (Fig. 1). Not stopping, however, to repeat what has been so well stated before, I would simply call attention to one point which I think is worthy of mention, viz: the plush-like "crest" of the

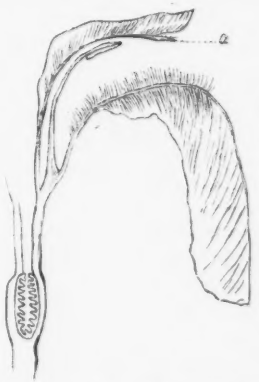

FIG. 1.—A section of portion of an Iris flower. *a*, stigma.

sepal. Is it not well adapted for tripping the smaller insects, or raising them, so that they shall hit the stamen and stigma, forcing them by increased activity, or by their walking on its top, to compensate for lack of size? In this arrangement of parts in the Iris we have the main features of a plan which is traceable in many other flowers.

Strangely enough many *irregular monopetalous* corollas seem to copy this *regular polypetalous* one in its method of cross-fertilization. This is especially true of *Martynia proboscidea* Glox., the unicorn plant. The general form and structure of the flower is shown in the figures. The lower petal forms a broad platform upon which the bee alights. As it enters the tube (which I believe is broader before fertilization, the roof rising as the corolla fades), it first brushes the lower lip of the stigma, Fig. 3 *a*, then while getting the nectar at the bottom of the tube its back is dusted by the anthers. As it withdraws, the flexible lobe of the pistil, like a valve, allows the pollen to pass without touching the stigma, which is on its upper or inner surface. This lower lobe is very sensitive before fertilization, during which time it hangs nearly vertical. In the case of a flower kept for examination, as soon as it was touched with a mass of pollen it rose toward the upper lobe so rapidly that its motion was very perceptible.

FIG. 2.—Side view of *Martynia proboscidea*. (Natural size.)

FIG. 3.—Cross-section of *Martynia proboscidea* showing arrangement of pistil and stamens. *a*, flexible lobe of stigma as before fertilization.

In the Penstemons (my observations are mainly upon one species, *P. glaucus* [?] Grah.[1]), we

[1] The notes presented were made last June on a species occurring abundantly in Central Nebraska. The species was not familiar to me: I made a hasty sketch of the flower as given. Certain notes of the characters of the plant were taken, but not enough to decisively distinguish it from the many species of the same genus occurring in that region.

have another slight variation of the plan. The corolla tube is broad and large. On the upper side are the four anthers in two pairs, and above them, or back of them, the pistil with undivided stigma. Before the anthers discharge their pollen the style is straight lying close to the upper side of the tube. While the pollen ripens and is discharging, the style elongates, and its end, after passing the longer stamens, turns abruptly downward. This position is not usually taken till the pollen is all gone from the flower. This arrangement brings the stigma right in the way of any insect entering the flower, and scrapes from it the pollen it may have received from some neighboring flower in which the stamens are discharging pollen.

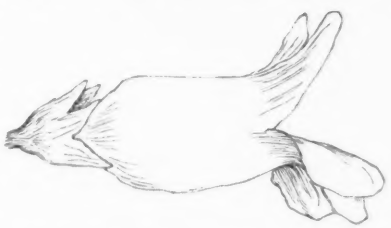

FIG. 4. — *Penstemon glaucus* (?). Side view. (Natural size.)

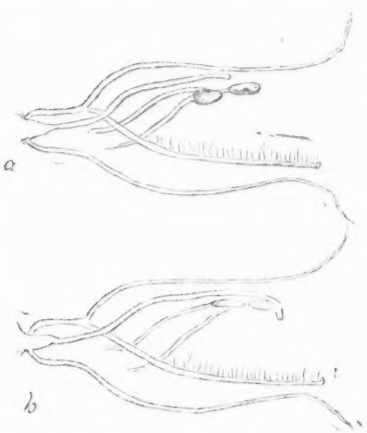

FIG. 5.—Cross-sections of the same. *a*, staminate stage; *b*, pistillate stage.

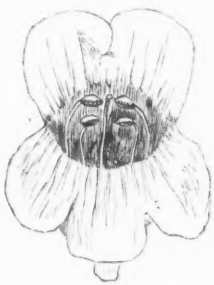

FIG. 6.—Front view of the same after discharge of pollen.

The following table, showing relative development of pistil and stamens in *P. glaucus*, gives full authority for the above statements:

	Anthers discharged.	Partly discharged.	Closed.
Pistils straight	0	7	27
" curved	21	17	1

It is to be regretted that the degree of curvature of the pistil was not more carefully noted; it may be said, however, that

generally it was considerably less when the pollen was partially discharged, than when it was entirely discharged.

We see very clearly, therefore, how the later development of the pistil with the curving of the style in this case accomplishes the same end as the flexible bi-lobed stigma placed in front of the stamens, as in the *Martynia*.

It is very interesting to find in the lower side of the tube, in the Penstemon, the fifth stamen, which is sterile and *bristling* with hairs, serving the same purpose, apparently, as the crested sepal in the Iris.

In the *Gladiolus* a relation of pistil to stamens is found similar to that in the Penstemon, while in several of the *Labiatæ* we find both the valve-like arrangement of the stigma and the later lengthening and bending of the style.

In *Lobelia syphilitica* L., as probably in all the Lobelias, we find a very different arrangement, but accomplishing the same result, viz: cross-fertilization of the plant.

The corolla is monopetalous and two-lipped, the lower lip consisting of three petals and the upper of two. Between the latter is a slit extending to the base of the tube. The five stamens are free from the corolla and united, their anthers and upper parts of the filaments forming a tube; or it may be said, the anthers combining, form a common cell for the pollen, which opens by a pore at its apex. On the lower margin of the pore are many short stiff hairs, which at first project across the pore closing it, but when the pollen is ripe they turn abruptly downwards and leave it open. There is only one pistil, which is armed near the end of the style with a collar of short stiff hairs, similar in size and character to those on the anthers just mentioned. The end of the style with its hairs forms the bottom of the pollen-cell before

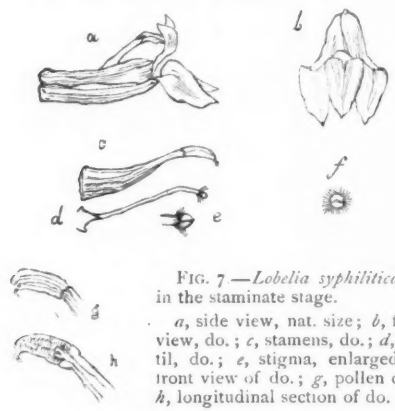

FIG. 7.—*Lobelia syphilitica* L., in the staminate stage.

a, side view, nat. size; *b*, front view, do.; *c*, stamens, do.; *d*, pistil, do.; *e*, stigma, enlarged; *f*, front view of do.; *g*, pollen cell; *h*, longitudinal section of do.

described. We have, therefore, the stigma shut up with the pollen in the same cell. "A capital arrangement for *self*-fertilization," one says. Nay, not too fast! The stigma is composed of two fleshy lobes, its receiving surface being on their inner surface. And they are closed firmly together, so that the end of the pistil looks like a closed mouth with its lips firmly pressed together. With its bristly collar it reminds one of Jack-in-a-box, with an unusually "stiff upper lip."

This combined pistil and stamens is S-shaped, and when the flower opens, it springs through the slit on the upper side of the corolla and stands with the tip of the pollen-cell just behind the upper lip of the corolla, vide Fig. 7 *a*. The front view of the same is given in Fig. 7 *b*. Sometimes there is no trace of the stamens seen from the front; but if an insect tries to enter, the slit between the petals opens, the hairs of the anthers strike his back, and as he forces his way in, they produce a jarring of the pollen-cell which freely sprinkles the pollen upon him.

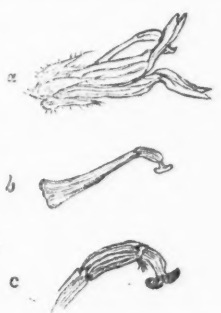

FIG. 8.—*Lobelia syphilitica* in the pistillate stage. *a*, side view, nat. size; *b*, pistil and stamens; *c*, anthers and stigma, enlarged.

As the pollen escapes it is kept up to the pore by the pressure caused by the gradual lengthening of the style. The hairy collar acting like a swab, sweeps the cell clean. When all the pollen is gone, the style, continuing its growth, pushes the stigma through the pore and forward through between the upper petals. The end of the style then comes downward, the lips of the stigma open and roll back as though turning inside out. This exposes the whole surface of the stigma to be covered with pollen from the back of the first insect which comes from a flower discharging pollen. So the cross-fertilization is beautifully accomplished.

These entertaining structures present some very suggestive ideas. We are impressed with the importance of cross-fertilization in the economy of nature, but why it should be of any advantage who can tell? We readily see that in several of these cases cross-fertilization between flowers upon different roots is likely to be quite rare. In *Martynia* such fertilization may be quite frequent, as there are comparatively few flowers open at once, but

in *Gladiolus*, *Penstemon*, *Labiatæ*, etc., there are many flowers on the same root at the same time, presenting the various stages of advancement. The chances are strongly in favor, therefore, of their being fertilized by pollen from flowers on the same root. In the Iris, notwithstanding its elaborate structure to secure cross-fertilization, it is quite probable that a particular pistil will be fertilized by the pollen from a stigma of the *same* flower.

While, therefore, we may admit that these contrivances may be to render a little more frequent the transfer of pollen to ovules on different plants, yet it impresses the thought upon us that each flower (and in the Iris each *third* of what is commonly called a flower) is a distinct vegetable unit. Therefore separate plants, as they are commonly called, like their marine mimics, the Hydroids, would be colonies, composed of hundreds or even thousands of *phytons*.

One more lesson, which we find given in the following admirable words of Prof. Gray:

"Now, no matter whether or not the flowers themselves, with all these structures, have been perfected step by step, through no matter how long a series of natural stages—if these structures and their operations, which so strike the mind of the philosopher no less than of the common observer, that he cannot avoid calling them contrivances, do not argue intention, what stronger evidence of intention in nature can there anywhere possibly be? If they do, such evidences are countless, and almost every blossom brings distinct testimony to the existence and providence of a Designer and Ordainer, without whom, we may well believe, not merely a sparrow, not even a grain of pollen may fall."

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CURIOUS ABORIGINAL CUSTOMS.

BY W. J. HOFFMAN, M.D.

ONE of the most singular and wide-spread customs practiced by the aborigines of North America, was that of cutting off the nose of the woman found guilty of adultery. In a previous article in the NATURALIST,[1] several tribes were referred to as having practiced this mode of mutilation—one or two of them to within recent times. Since the publication of that paper, I have met with various references upon the same subject, which may be of sufficient interest to enumerate. The earliest notice of the

[1] Am. Naturalist, xii, 1878, pp. 560–562.

execution of this punishment dates back to the year 1660, when the Jesuit Fathers first penetrated the then extreme North-west. The informant says, in a letter to Father Claude Boucher,[1] that the Nadouechiouec (Dakotas) cut off the cartilaginous portion of the nose of an adulteress. John Payne,[2] in quoting Carver, states that, "Among this nation of Indians (Nawdowessies, *i. e.*, Dakotas), if a married woman is found to have been false to wedlock, the punishment inflicted upon her is for the husband to bite off her nose; this our author saw inflicted whilst he was in the country."

I had received information to this effect in 1872–73, while I was stationed on the Upper Missouri, but coming as it did from unreliable sources, I gave no credence to the stories of bygone punishments, as I had not seen any references to this practice among any tribes north of Arizona. Now, however, I am inclined to believe that there was some truth in the assertions above referred to. Several days ago, in conversation with several gentlemen upon aboriginal customs and manners, I chanced to mention this form of punishment, when one of them (a prominent official of the B. & O. R. R. Co.) remarked that he had seen squaws among the Utes, near Ft. Bridger, thus mutilated, and was told at the time, less than two years ago, that they had been punished for infidelity. No doubt others scattered over the extreme western portion of the continent practiced the same cruel custom at no remote time.

This extended throughout some of the tribes formerly inhabiting the country between the Mississippi and the Atlantic. Caleb Swan, writing about 1791, says,[3] that prostitution was common among the Creeks, and scarcely any attention was paid to it, as far as any punishment was concerned. But, when a marriage has been contracted according to the more ancient and serious custom of the tribe, it is considered more binding than ordinary, and in violation of this law, or in taking the least freedom with any other person, is considered adultery, "and invariably punished by the relations of the offended party, by whipping, and cutting off the hair and ears close to the head." In this case the ears are named only, but very probably the nose was included in

[1] Margry, Jesuit Rel. i, 1876, p. 53 *et seq.* [Extrait de la Relation de la Nouvelle-France, de 1660, addressée au Révérend Père Claude Boucher.]

[2] Universal Geography, iv., 1799, p. 42.

Schoolcraft, v, 1868, p. 269.

some instances, as the latter was the organ chosen by tribes living near the border of the territory occupied by the Creeks. As before stated in the NATURALIST (Vol. xii, p. 561), Gregg[1] says of the Comanches that the "punishment is most usually to cut off the nose or ears, or both." The same author also says that the Creeks practiced the same custom[2] (having reference to the preceding).

Bancroft[3], in quoting Las Casas, says that in Itztepec (Mexico) "the guilty woman's husband cut off her ears and nose." The punishment among the Meztecs was sometimes commuted to mutilation of the ears, nose and lips.[4]

John Johnson,[5] referring to the Indian tribes inhabiting Ohio, says, "*Adultery* is punished by the family and tribe of the husband. They collect, consult and decree. If they determine to punish the offenders, they usually divide and proceed to apprehend them, one-half going to the house of the woman, and the other half to the family house of the man, or they go together, as they have decreed. They apprehend them, beat them severely with sticks, cut off their noses, and sometimes crop them, and cut off the hair of the woman which they carry home in triumph. If both parties escape, and those in pursuit return home and lay down their weapons, the crime is satisfied; if they apprehend but one of the offenders, and the other escape, they take satisfaction from the nearest of kin."

In this paper of Johnson's (who by the way was considered good authority) are enumerated the following tribes, viz: "Wyandots, Shawanoese, Senecas, Ottawas, Delawares, Miamies, Putawatimies and the Weas." It is questionable whether the Senecas, who were of the Six Nations, ever practiced this custom, as at no other time have I met with the names of any of the latter in this connection.

As before stated, the custom of cutting off both the ears and nose extended down into Central America, and César de Rochefort,[6] in speaking of the Caribs, refers to this custom as practiced

[1]Commerce of the Prairies, 1844, ii, 308, 309.

[2]Ibid, p. 308.

[3]Bancroft in Native Races, ii, 466, quotes Las Casas, Hist. Apologética, MS., cap. ccxiii.

[4]Ibid, p. 466. [Herrara, Hist. Gen., dec. iii, lib. iii, cap. xii.]

[5]Archæologia Americana, i, 1820, p. 285.

[6]Histoire des Antilles, 1681, p. 548. Quotes Lenscot, ch. 16, for Bengalese.

by the Bengalese, but makes no mention of it in reference to the Caribs. It would appear that some similarity existed, or he would not have been prompted to make reference to such an odd custom practiced near the opposite side of the globe. The Egyptians[1] cut off the nose of the guilty woman, and the man was beaten with rods; this is again, and very remarkably too, noticed in the punishment of the Nicaraguans.

The above references have been collated with the intention of illustrating the wide-spread prevalence of this singular and barbarous custom, and for the purpose of inducing the publication from others upon the same subject, for the purpose of ascertaining to what tribes and families the knowledge of it extended.

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NOTES ON A LOST RACE OF AMERICA.

BY LIEUT. A. W. VOGELES, U.S.A.

NO department of natural history appears at present to attract more general interest than that which relates to the prehistoric Aborigines of North America; nor is this to be wondered at, for throughout the extensive valley of the Mississippi, and also in the Gulf States, we find numerous mounds and remains of ancient fortifications; they have, however, been so ably described in the different scientific journals, that we shall confine the subject of this essay to those of Western Florida, which are not so generally known.

Of these ancient people no written history remains, nor can any reliable account be obtained from the Indians inhabiting the States, or from the earliest Spanish explorers. The Spaniards are silent upon the shell mounds of Florida, although they visited Tampa in 1512. We know only of the existence of these mounds, and of the arts, industries and manner of interment of the people who made them, and from these we can only add a link to the chain of evidence that connects the eastern mounds of Florida with those of the western coast.

The only group at Tampa, Fla., of importance to the archæologist, is a series of shell mounds running obliquely across the town, commencing on the southern seashore, on the military reservation of Fort Brooke, and extending to the Hillsboro

[1] Diodorus Siculus. Lib. i.

river. During the Florida war this series was complete, but at present it consists only of a large mound on the military reservation. The second, which was located immediately outside of the reservation, has been destroyed with the third mound situated near the site of the present town market. At the foot of the last mound in the clay banks of a small stream which flows into the river we find chippings of flint implements.

The only remaining representative of the ancient series of mounds is conical in form, being about fifteen feet in height, with a diameter at its base of about fifty feet. By digging into this mound, commencing at its apex. we found that its surface consisted of drifted sand, about five feet in depth; immediately beneath this we uncovered a layer of shells made up of the edible species of our southern coast, and generally composed of old valves of *Ostrea virginiana*, although among the shells there are a few fossil species which are common to our tertiary marls.

Immediately beneath the shells, in a white sand which forms the principal material of the mound, we uncovered a male skeleton, which was interred at an angle so that the head laid toward the east and south. It is remarkable that in the vicinity of the body we were unable to discover implements or ornaments. Continuing our excavations on the same level in a southerly direction, we found the remains of a second body, consisting of the pelvic bone of a female, and other parts with the exception of the skull.

It is worthy of remark that the sandy structure of this series of mounds corresponds with that of the sand dunes of our present sea coast which, in connection with the well-known geological fact of the former elevations and depressions of the Atlantic coast, would give a reasonable explanation for the phenomena observed in the study of the Tampa mounds. The recent elevation of the shore around Tampa is evident from the fact that immediately in the rear of the Fort Brooke mound we found a ridge parallel with the present southern shore line; it is composed of wave-broken shells, and probably formed the ancient shore line during the occupation of the mound, and has since been raised, although previous to its existence the whole shore line had a series of elevations and depressions, a fact which becomes self evident from an observation of the country directly in rear of the town of Tampa.

We would suggest the theory that these mounds were formed in the same way as our present sand hills along the Atlantic coast, and that in their sheltered position in Tampa bay, their form was preserved during the series of depressions of the coast by the shelly deposits made upon them by their inhabitants.

In digging into the sides of the Fort Brooke mound, we discovered the position of the original fire places, and in their ashes we found that the largest proportion of animal remains consisted of those of mankind. The longer bones, and especially the flattened tibiæ were charred and split; these were intermixed with those of the dog, deer and also burned oyster shells and portions of the common edible sea crab.

These incremations of human remains by the mound-builders, were evidently for the purpose of preparing food; at least we would so judge from the fact that the marrow bones are charred and split. We have then here the kitchen of a race of cannibals.

The pottery of the mound found near the former fire-places and also the implements, are very primitive; the latter consist of arrow heads, and in the former, which is generally plain in style, although now and then a few pieces of an ornamented pottery marked with chevron lines are found, the typical forms of the eastern mound group of Florida generally prevails.

The Cedar Key group of Florida is not contemporary with the shell mounds of Tampa, at least we would so judge after our investigations of that group with our friend Mr. Calkins, of Chicago. The pottery of the Cedar Key group is certainly much more ornamented than the former; this taken in connection with the number of implements found in these mounds by Mr. Calkins would certainly show a higher degree of advancement.

The habits, ceremonies and manner of interment of this lost race are parallel with those of the ancient Danes. These people constructed artificial hills for the sepulchre of their kings.[1] The cannibalistic habits are similar to those of the Troglodytes found in the caverns of Mount Chauvaux in the province of Namur, Belgium.

[1] Pascalis, an Exposition of the Danger of Interment in Cities, p. 12.

THE GEMMULE *VS.* THE PLASTIDULE AS THE ULTIMATE PHYSICAL UNIT OF LIVING MATTER.[1]

BY JOHN A. RYDER.

AS is well known to every well informed person, *protoplasm* is now regarded as the substance which enters universally and constantly into the composition of the living form-elements or cells of all living things. It is, therefore, the material basis of life. All the varieties of organic structure, no matter how different from each other, have been primarily differentiated from apparently homogeneous protoplasm. Premising, therefore, that we understand that all histological differences presented by the tissues of living organisms arise by differentiations of, or secretions, derivatives of *plastids* (cells) primitively alike, we are ready to consider the theories advanced to account for the phenomenon of hereditary transmission. *Transmission* or *heredity* may be defined as that inherent tendency acquired from ancestry and manifested by developing or growing organisms to become essentially like, in appearance and structure, their immediate ancestor or ancestors, if the parentage be a sexual one. The appearance of a characteristic belonging to a remote ancestor in a new organism, which characteristic did not belong to its immediate ancestor, is said to be a case of reversion or atavism. This is explained upon the assumption—a rational one—that in the germinal matter, that is, a plastid, or an egg-cell or a sperm-cell or cells, if reproduction be sexual, derived from the immediate ancestor, may still inhere a tendency to develop characteristics belonging to the most remote of, an indefinite number of removes back, from such immediate ancestor. The tendency to develop such palæontological characters is supposed to remain in a latent or potential state in all those generations intermediate between the ancestor in which this characteristic was present and the young organism in which it has again made its appearance. In this way gradually but continuously, and adaptively acquired characteristics are transmitted, as well as habits. It may be that profound and enduring sensory impressions upon the maternal organism in higher forms, by their persistence, may produce immediate effects upon the offspring which cannot be attributed to ancestry. The many

[1] Embracing the substance of an essay read before the Microscopical and Biological Section of the Academy of Natural Sciences, of Philadelphia.

recorded instances in the human family of the effect of the so-called pre-natal influences would justify such an inference.

The phenomena of development presented by the embryological history of an organism, are serially or successively related to series of ancestral forms in a way which shows that the most remote ancestor was indubitably unicellular, for all beings commence their embryonic history as a one-celled egg, or as an egg-cell fused with one or more unicellular spermatozoöids. To this law no exception has ever been discovered. It passes at first by a process, then by processes, as complication is established by the former; not by leaps, but from one stage to the next higher, and so on in an absolutely continuous manner, so that it is impossible to mark the transitions, so that absolute *continuity* becomes a fundamental characteristic of the process of development.

It has also been noted that these successive stages, or a part of them, often represent, perhaps always within the limits of groups, a sort of recapitulation or successive shadowing forth, sometimes faintly, sometimes strongly, of the forms which appear to represent the phases through which the organism has passed in attaining its present form and structure. The process of development accordingly shows in a pronounced, or may be dim way, the types which have successively formed the starting points of its development in past time. A *phylum* or branch from the tree of life or chain of ancestors, is thus represented in its embryonic history. The being, in its evolution from the ovum, accordingly recapitulates the forms of its successively more and more complex, or more and more modified ancestral series—its palæontological history preserved in the rocks together with more or less note of its living cotemporary allies. The fossil forms of successive formations are frequently found to bear such a relation to the developing embryo. The rock record linked with the now living one is said to be the *phylogenetic* history, that is, it unfolds the history of the *phyla*, or branches of the tree of life. The history of the being or ontological history, therefore, becomes a more or less distinct record of the phylogenetic. In a word, *Ontogeny*, or the development of individual beings, is an epitome of the *Phylogeny* or phylogenesis of the race to which they belong.

This doctrine and its modifications is the motive force of modern *Biology*. Upon this ground, *Laplace*, *Lamarck*, *Wolff*,

Von Baer, Darwin, Spencer and *Haeckel* have given to the science new impulses and aims far higher than possessed its masters in its infancy.

Dr. Darwin, in order to account for the phenomena briefly set forth in the above remarks, had recourse to what he called the "*Provisional Hypothesis of Pangenesis.*" The following is Mr. Galton's brief statement of the hypothesis:

1. Each of the myriad cells in every living body is, to a great extent, an independent organism.

2. Before the cell is developed, and in all stages of its development, it throws "gemmules" into the circulation, which live there and breed, each truly to its kind, by the process of self-division, and that consequently they swarm in the blood in large numbers of each variety, and circulate freely in it.

3. The sexual elements consist of organized groups of these gemmules.

4. The development of certain of the gemmules in the offspring depends upon their consecutive union through their natural affinities, each attaching itself to its predecessor in a natural order of growth.

5. That gemmules of innumerable varieties may be transmitted for an enormous number of generations without being developed into cells, but always ready to become developed, as shown by the almost insuperable tendency to feral reversion in domestic animals.

Galton, in order to test the truth of the foregoing hypothesis, transferred the blood of different breeds of rabbits from one to the other, actually establishing a cross-circulation, in which cases the blood flowing from one individual to another was practically unchanged. After this operation upon the animals, the young ones reared by these were not found to have been influenced in the slightest degree by the admixture of foreign blood with that already contained in the vessels of their parents, which should not have been the result were the hypothesis of *pangenesis* a true one. *Pangenesis* having been subjected to a crucial test and found wanting, nothing was offered, as an avowed substitute, until Haeckel proposed his *Provisional hypothesis of the Peregenesis of the Plastidule*, except by Prof. Cope, who, in his "Origin of Genera" (Proc. Acad. Nat. Sci., Phila., 1868), and afterwards in a paper entitled "On the Methods of Creation of Organic Types" (Proc. Am. Philos. Soc., 1871) more fully developed the views presented in the first mentioned. His views will be considered after Haeckel's have been discussed.

The *plastidule* of Haeckel is hypothetically the molecule of protoplasm, and therefore the simplest possible form in which protoplasm can exist as protoplasm. The theoretically high degree of complexity of the molecule of protoplasm renders it in the highest degree susceptible to influences brought to bear upon it by its environment. Primarily its atomic constitution C H O N, must be related in some way to its properties.

Haeckel attributes to every existing atom a modicum of force or energy as eternal and quantitatively unchangeable as the atom itself, which he calls the *atom-soul;* by aggregation of the atoms into chemical compounds, the mode and nature of the manifestation of individual atomic energies become mutually modified, and as resultants we have different properties and behavior manifested by such different compounds. By a long process of differentiation a compound was finally evolved answering in composition and properties approximately, or entirely, to existing protoplasm. This highly unstable matter, representing the aggregate or resultant of the energies of its component atoms as the energy of living matter, became the ancestor of some primordial amorphous being out of which, by adaptation and "survival of the fittest" the ancestors of the *Protista* became differentiated. On the principle that motion or impulses once imparted to bodies tend to be perpetuated in the absence of other interfering causes, the energy of movement, called life, once set going tended to be kept up, and in order that it could withstand the interference of a great variety af disturbing causes, it gradually acquired the power of adaptation. This adaptation being simply vibration of its molecules in unison with outer conditions as a resultant of those conditions. From the well known postulates in regard to the persistence of matter and motion, it is clear that the molecules of different masses, subjected to differing conditions, would gradually acquire different modes of molecular motion, which would tend to be persistent and perhaps approximately alike throughout the same mass. Any part of this mass broken off would tend to retain the molecular movements and consequently the properties of that of which it at first formed a part, but the new conditions to which it might become subject in the event of separation, render it probable that these motions might have others superadded, or the old ones so changed as to give rise to different phenomena. Different food, temperature, surrounding, media, etc., are thinkable

as immediately active causes in the differentiation of the modes of molecular activity. Accordingly by the persistence of the type of molecular motion or motion of the *plastidule*, its characteristics tend to be exactly reproduced where reproduction is a process of mere division, as in the *Protista*. On the other hand, the motion of plastidule tends to vary as the surrounding conditions vary. Hence the difference in individuals arising from this adaptive power of the plastidule to accommodate its motions to the environment. Where the process of reproduction is sexual the fusion or blending of the products of the sex-glands to form embryos, there results a blending of the plastidular motion of the two. The characteristics of the resulting being is hence a resultant of two molecular modes of motion in the same way as the diagonal of a parallelogram of forces is the resultant of two more or less antagonistic forces. Putting this and that together, it is clear in what manner the characteristics of the offspring of sexual unions may come to preponderate in favor of the one or the other parent as the plastidular-molecular motion of the germ elements preponderates over that of the sperm element, and *vice versa*, thus mutually modifying each other in order to produce a resultant. It is also conceivable that the plastidular motions of remote ancestors as well as of approximal ones, tending to be persistent, may suddenly re-appear under favorable conditions, and that in this way there may arise a tendency to revert to such ancient progenitor. This hypothesis, if extended so as to conceive of the molecular vibrations of different stages of development as composing parts of a great molecular rhythm coeval with the first appearance of life on the earth, also explains the phenomenon of the recapitulation of *Phylogeny* and *ontogeny*. The tendency is to manifest the molecular motions in the order in which they succeeded each other in time. The registry or repetition in ontogeny being not always exact, it may be assumed that in the process of differentiation some of the types of vibration were in these instances irrecoverably lost.

Stated thus briefly, it seems to me unnecessary to enter into the account of the hypothesis of *perigenesis* further than to impress upon the mind of the reader that the vibrations of the plastidules are adaptive in character, that is, they are the resultants of outward conditions, represented hypothetically by X or any other unknown static or dynamic quantity. The theory is therefore purely me-

chanical and causal, and hence the word *perigenesis*—generated by surroundings. It seems to me that some form of hypothesis similar to this will be adopted unless the current views in regard to the physical constitution of matter undergo very great changes. It may be, if reports be true, that the so-called elements are not elementary, as Mr. Lockyer has been led to suspect from his spectroscopic researches, but even this will not destroy the essential elements of the problem, which are undoubtedly to be expressed in terms of matter and force without respect to what the nature of that matter may be.

Prof. Cope (l. c.) after discussing at length the evidence in favor of the correlation of life forces with the other physical forces and its conservation, goes on to particularize as follows: "Dr. Carpenter, in describing the correlation of physical and vital forces, defines the difference of organic species to be similar to that prevailing between different chemical bodies (the latter depending on different molecular and atomic constitution), which leads them 'to *behave* differently' from each other under similar circumstances. This may be more fully expressed by saying that different species possess different capacities for the *location* of the conversion of the physical forces into growth force." On this basis, "A 'descent with modifications' contemplated by evolution signifies a progressive change in this capacity." Applied to the explanation of his law of *Acceleration* and *Retardation*, he says: "*Acceleration* means an increase in this capacity; *retardation* a diminution of it." In other words, the undulations or vibrations of the molecules of different organisms and different parts of organisms differ in character, which is essentially the doctrine of Haeckel. He also speaks of growth force [energy] as cumulatively *potential* (p. 26). Its degree of potentiality he considers as marking the degree or grade of *grade influence* as manifested by successive higher forms. Grade influence is supposed to be the resultant of "effort and use" in the process, so that the static or dynamic environment and the organism are considered to be in a relation of retroactivity—in a state of interaction. At page 29, "Method of Creation," *On the transmission of Grade Influence*, the author admits: "How force potential in nerve structure is inherited through the reproductive elements is a great mystery," but he observes further: "In the spermatozoöids * * * growth force [energy] remains potential," that is, in a static condition,

ready to be set free in the dynamic process of fertilization of the ovum, and of embryonic development. "Growth force potential in the spermatozoid, on its destruction [fusion with the egg] becomes converted into heat or other force. Thus may originate the growth force of the ovum, which, once commenced, is continued through the period of growth." It seems to me probable that the process of repetition is simply a phase of the manifestation of growth force as in the asexual fusion of growing cells, formation of spores in low plants and navicellæ cysts in *Gregarinæ*. It seems to me probable, also, that the cleavage of the yelk of the ovum supervenes just as soon as the static condition of its molecules is interfered with by blending with the spermatozoöid whose molecules are in a dynamical or potential condition as aforesaid. It is clear that if this is true, we get a composite result or resultant. In point of fact, this is tacitly implied where Prof. Cope says in continuation: "The process might be compared to the application of fire to a piece of wood. The force conversion is communicated to other material than that first inflamed." That is, the molecular movements of the embryonic mass, viz., sperm and germ, tends to be assumed by all the material which it appropriates to itself; this may be extended to the process of digestion or appropriation of protoplasm in animals and to the formation of protoplasm by plants when in growing conditions from binary and ternary compounds It is also clear that the quantitatively indefinite element x of the modifying environment of the plastidule is admittedly involved in consideration of the effect of *use and effort*, as held by this distinguished biologist, and that if use and effort are modifying causes, and molecular vibrations, whether they be in waves or ellipses or curves of any kind, will be influenced and accordingly modified. It must also necessarily be implied that these effects are persistent and that they involve the idea of *Perigenesis* quite as much as the plasticule.

The totality of the phenomena of *differentiation* and *reduction* (*specialization, cephalization*) in living forms, are, in view of the foregoing considerations, it seems to me, to be referred to dynamical causes. Laplace, from a mathematical standpoint, saw that this must be so. Lamarck, in his *Philosophie Zoologique*,[1] in the chapter VII, tom I, pp. 218–268, entitled, "*The influence of circumstances upon the actions of animals*," has some observations

[1] Nouvelle Edition, tom. I and II, Baillere, Paris, 1830.

which show what a profound conception he possessed of the causal relations existing between the uses of parts and their development. Of recent authors, Darwin must occupy the first place, as many of his hosts of facts are admitted by him to bear a more or less distinctly dynamico-causal interpretation (*vide, Variation of Animals and Plants under Domestication*). By far the most comprehensive principles of dynamical biology have, however, been suggested by Herbert Spencer,[1] and they must be regarded as the first attempts at scientific presentation of the subject, in which, although the factors of the problem were not stated quantitatively in most instances, yet enough was said to show the applicability of the quantitative method. Besides these authors, more recent writers have begun to pay attention to the subject. Prof. Owen has for many years avowed his leaning to Lamarckianism. Prof. Jäger,[2] of Stuttgart, has written upon the influence of mechanical strains in determining the length, etc., of bones. Prof. Lucae, of Frankfort, a. M., has also contributed to this subject. Gegenbaur, in his "*Elements of Comparative Anatomy*," has numerous observations upon this subject. Prof. Cope may be added to this list, having contributed an article bearing solely upon this subject, to this journal, within the past year. This author, who, as we have seen, had already advanced views similar to Haeckel's, which, if not as clearly expressed, were nevertheless published more than five years previously. These names show that I have not been alone in the study of animal metamorphosis as produced by means of dynamical agencies. I have always held that both the organism by means of its voluntary acts and its passive surroundings reacted upon each other so as to produce morphological and consequently structural changes. My short essay, "On the Laws of Digital Reduction," which appeared in this Journal (Oct., 1877), and which was republished in the *Kosmos*, for 1878, illustrates what I have just said. My papers on the "Mechanical Genesis of Tooth-forms"[3] also show the application of the method, besides minor papers on the mechanical differentiation of certain portions of the vertebral column, in this Journal and Popular Science Monthly, 1877.

The logical consequences of the acceptance of the Hypothesis

[1] *Principles of Biology* and also his *Principles of Psychology*.

[2] *Jenaische Zeitschrift*, Bd. V., 1869.

[3] *Proc. Phila. Acad. Nat. Sciences*, 1877, and the *Dental Cosmos*, 1878 (Etiological Addenda).

of the Perigenesis of the plastidule, and with it the theory of dynamical differentiation—because the latter is no longer a hypothesis—forever relegates teleological doctrines to the category of extinct ideas. No matter how much our ideas may need to undergo modification, some similar hypothesis must eventually hold sway over the minds of biological thinkers, as the facts of science point in that direction and in no other.

It has been suggested in conversation by my friend Dr. A. J. Parker, of this city, that the assumption of the *plastidule* as the ultimate physical unit of living matter was unnecessary, as it consisted merely in naming the protoplasm molecule, and it must be admitted that this view of the case is not without reason. Prof. Haeckel, it is to be supposed, however, adopted this name merely to distinguish his own provisional hypothesis from that of his acknowledged master. The word *plastidule* is a diminutive of the current word *plastid*, which is synonymous with cell, and therefor, implies and correctly, too, that the *plastids* are aggregates of varying numbers of plastidules, which are for physical reasons the smallest possible or conceivable units of living matter, of which even the most minute *gemmæ* or budding cells are composed.

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ABSORPTION OF WATER BY THE LEAVES OF PLANTS.

BY ALFRED W. BENNETT, M.A., B.S., F.L.S.

ALTHOUGH gardeners universally maintain that growing plants have the power of absorbing water through their leaves, both in the liquid and the gaseous form, in addition to the power of suction through the root, yet the contrary theory has been in favor during recent years among vegetable physiologists. The first recorded experiment, of any value on the subject, was about the year 1731 by Hales, as described in his "Vegetable Statistics;" the conclusion to which he came being that "it is very probable that rain and dew are imbibed by vegetables, especially in dry seasons." This result was confirmed by Bonnet in 1733. A century later, however, in 1857, Duchartre, experimenting on the absorptive power of plants, came, after considerable wavering, to the conclusion that rain and dew are not absorbed by the leaves of plants. This opinion has been, with but little exception, held by all physiologists during the last twenty years, notably by

DeCandolle and Sachs; the explanation offered of the fact that withered plants revive when placed in moist air or when the leaves are moistened, being that transpiration is thus stopped, or is more than counterbalanced by the root-absorption. In his "Text-book of Botany" (English edition, p. 613) Sachs says: "When land plants wither on a hot day and revive again in the evening, this is the result of diminished transpiration with the decrease of temperature and increase of the moisture in the air in the evening, the activity of the roots continuing; not of any absorption of aqueous vapor or dew through the leaves. Rain again revives withered plants, not by penetrating the leaves, but by moistening them and thus hindering further transpiration, and conveying water to the roots, which they then conduct to the leaves." McNab has, however, proved that leaves do transpire, even in a moist atmosphere, provided they are exposed to the action of light. The result of recent experiments, conducted by Boussingault in France, and by the Rev. George Henslow, in England, seem to force us to return to the earlier theory held before the time of Duchartre.

Boussingault's experiments relate not only to the absorption of water by leaves, but also to transpiration under various atmospheric conditions. The first experiments were as to the amount of transpiration from the Jerusalem artichoke in sunshine, in shade and by night. This he found to be hourly, for every square metre of foliage, sixty-five grammes in sunshine, eight grammes in the shade, and three grammes during the night. In the vine the corresponding numbers were thirty-five grammes in sunshine, eleven grammes in shade, 0.5 grammes by night. He reckoned that an acre of beet could give off, in the course of twenty-four hours, the enormous amount of between 8000 and 9000 kilogrammes of water, and a chestnut tree, thirty-five years old, sixty litres of water in the same time. The next question investigated was whether the absorption of water by plants, and the ascent of the sap, are due to the force resulting from transpiration on the surface of the leaves, or whether the roots exercise also a certain amount of force to this end. In the case of mint, a plant with roots, showed an hourly evaporation per square metre of eighty-two grammes in the sunshine, and thirty-six grammes in the shade; without roots the evaporation was sixteen grammes in sunshine, fifteen grammes in shade. The effects

of pressure on the absorption were next examined. A chestnut branch dipped in water was found to transpire hourly sixteen grammes per square metre; when inserted into a tube of water and subjected to the pressure of a column of water two and a-half metres high, the evaporation amounted to fifty-five grammes per square metre per hour, and the branch, at the end of five hours, weighed more than at the commencement. As to the effect of the epidermis in restraining evaporation, he found that an apple deprived of its skin loses fifty-five times as much water in the same time as one with its skin entire; while similar experiments in the case of a cactus leaf showed a difference in the proportion of fifteen to one. Losses by rapid evaporation lessen appreciably the physiological energy of leaves. Thus an oleander leaf containing sixty per cent. of water, when introduced into an atmosphere containing carbonic acid gas, decomposed sixteen c. cm. of the gas; one containing thirty-six per cent. of water decomposed eleven c. cm.; while one containing twenty-nine per cent. of water was without action. As respects the relative power of evaporation possessed by the upper and under surfaces of leaves, he found the average proportien in a dozen different kinds to be as one in the former to 4.3 in the latter case.

Boussingault then proceeded to investigate the question of the ability of leaves to replace the roots of a plant in serving as the agent of absorption. A forked branch of lilac was so placed that one portion was immersed in water in a reversed position, while the other was exposed to the atmosphere, the superficies of foliage in both portions being the same. The transpiration from the exposed portion was found to be the same as under normal circumstances, and after the lapse of two weeks the foliage was as fresh as at the commencement, showing that the submerged leaves were fully able to replace the roots in supplying the shoot with moisture. A vine-shoot half plunged in water maintained a normal evaporation in the free foliage, and remained fresh for over a month. An oleander shoot, under similar circumstances maintained its normal appearance for four months. With the artichoke it was found necessary that the amount of surface of leaves beneath the water should be four times that above it. A number of experiments, with regard to the power of leaves to absorb water in the state of vapor from a saturated atmosphere, showed that they could do this only when they had previously lost a por-

tion of their water of constitution, *i. e.*, that which is essential to their normal existence. Thus a wilted branch of periwinkle, weighing four grammes, after remaining for a day and a-half in an atmosphere saturated with aqueous vapor, weighed 4.2 grammes; after twelve hours immersion in water it weighed 9.4 grammes. His last experiments related to the power of leaves to absorb aqueous solutions. Drops of water containing 0.2 per cent. of calcium sulphate in solution were placed on the leaves of a great variety of plants under conditions favoring absorption, and protected from evaporation by inverted watch glasses with greased edges. In most instances the drops were entirely absorbed, leaving no trace of the mineral matter. As in the case of pure water, the under surface of the leaf absorbed much more rapidly than the upper surface. Solutions of potassium sulphate and nitrate gave corresponding results; the absorption of solutions of sodium chloride and ammonium nitrate were not so perfect. It is obvious that these results must considerably modify the view at present held by physiological botanists, that the small quantity of ammonium carbonate contained in the air, which is believed to be the sole source of the nitrogen in the tissues and secretions of plants, can only be absorbed by the roots after having been brought down to the soil by rain.

Mr. Henslow's experiments, as detailed in a paper read at a recent meeting of the Linnæan Society of London, are altogether in harmony with those of the French professor. The results of a very large number of experiments extending over several years, may be epitomized as follows:

1. *The absorption of water by internodes.*—The experiment consisted of wrapping up one or more internodes of herbaceous plants in saturated blotting-paper, and in noting the effects. As a rule the leaves on the shoots rapidly perished, showing that transpiration was too great for the supply. The stems, however, kept fresh for different periods up to six weeks.

2. *Absorption by leaves to see how far they could balance transpiration in others on the same shoot.*—The general result is that as long as the leaves remain green and fresh in or on water, they act as absorbents; but that the leaves in air keep fresh or wither according as the supply equals or falls short of the demand.

3. *To test how far leaves on a shoot can nourish lower ones on the same.*—It appears that it is quite immaterial to plants whether they be supplied with water from the absorbing leaves being above or below those transpiring. Water flows in either direction equally well.

4. *Leaves floating on water.*—It was found that one part of a leaf can nourish another part for various periods, though the edges out of water died first.

5. *Absorption of dew.*—A long series of cut leaves and shoots were gathered at 4 P. M., then exposed to sun and wind for three hours, then carefully weighed and exposed all night to dew. At 7.30 A. M., after having been dried, they were weighed again, and all had gained weight, and quite recovered their freshness, proving that slightly wetted detached portions do absorb dew.

6. *Imitation dew.*— Like results followed from using the "spray," by which dew could be exactly imitated.

7. *Plants growing in pots*, and of which the earth was not watered, were kept alive by the ends of one or more shoots being placed in water; *e.g.*, *Mimulus moschatus* not only grew vigorously and developed auxiliary buds into shoots, but also blossomed.

By these interesting experiments the physiological botanist is again placed in harmony with the gardener who syringes his plants not merely for the purpose of washing off dust and insects, but in order to facilitate the actual absorption of water by the surface; and with the field botanist who sprinkles the plants in his vasculum with water to keep them fresh till he reaches home. Mr. Henslow concludes with the following hints as to preparing bouquets of cut flowers:

If some plants have buds upon them, let the stalks long, and allow a few leaves to remain on and be also immersed in the water, and the buds will then be often found to expand successively. The cut end, to be more absorbent than it otherwise would be, should be again cut off under water. If the blossoms be on a ligneous stem, as of lilac, then the loss of water by evaporation is greater than the woody stalk can supply, so that in this case the addition of leaves in the water will greatly aid, and retain the bunch of flowers fresh for a longer time. On the other hand, if a blossom be already about to shed its petals, then the additional supply of water furnished by the leaves on the stalk appears to hasten the coming dissolution, and the flower perishes rather sooner than it would otherwise do. The water must be changed every day, and the submerged leaves must be lightly wiped with a cloth, as by endosmotic action they soon become more or less coated with mucus. No leaves must be in water unless perfectly green and of vigorous growth.

THE BREEDING HABITS OF THE EEL.

BY A. S. PACKARD, JR.

THERE is a considerable degree of mystery regarding the spawning time of the common eel (*Anguilla bostoniensis*), the place of spawning, and especially the differences between the male and female. The following facts appear to throw some light on the subject, and are published with the hope that it may stimulate others to observe with care and in detail all the facts regarding the spawning habits of a fish which is interesting as being the lowest bony fish, and is more and more used as an article of food, several eel-fishing establishments having been lately started in this country.

So far as we are aware, the eggs of the American eel were first discovered by Mr. John Mooney, of Providence, R. I., in October, 1877. Mr. Mooney is an intelligent mechanic and a close observer, but entirely self-taught. He carried the eggs to Prof. John Pierce, of Providence, who assures me they were veritable eggs, and measured one-hundredth of an inch in diameter.

Late in December, 1877, Mr. Vinal Edwards sent eight eels to the Museum at Cambridge. These were examined by Mr. F. W. Putnam, who reported upon them to the Boston Society of Natural History.[1] He states that during the month of December eels were brought into New Bedford "with eggs in various stages of development; where they spawn is not yet known." The specimens examined by Mr. Putnam "had the ovaries in various stages of development. In two the ovaries were very small, and the eggs in them exceedingly minute. From these the series showed a gradual increase in the size of the ovaries and the contained eggs, to the specimen exhibited, in which the eggs were still so small as only to be seen by a lens of considerable magnifying power, and not yet ready to be excluded, though the ovaries themselves were large and full."

During the month of November, 1878, I found several eels in spawn in the Providence market, and at my request, Mr. Mooney brought me two eels, one of which he pronounced to be a female and the other a male. The ovaries of the female were larger and fuller than in any other female I have examined, and the eggs riper. The eggs of this eel, which was about two feet in length judging by the portion secured from the fisherman by Mr.

[1] Proceedings of the Boston Society of Natural History, 1878, Vol. 19, p. 279.

Mooney, were distinguishable by the naked eye, were well filled with yolk cells, with a clear nucleus, and measured nearly two millimetres (1.90 inch) in diameter. The under side of the eel was tinged with golden-yellow. Mr. Mooney's so-called male was darker, dull silvery beneath. A microscopic examination showed that the thin sexual gland was quite different in histological structure from that of the ovary, and the examination of several undoubted male eels, with active spermatozoa, showed that Mr. Mooney was right in his conjecture that his supposed male was really such.

Fourteen eels were then obtained, from twelve to about sixteen inches in length, and ten of them were examined with a Tolles fifth and Hartnack immersion, No. 10. Several females were examined, and it was found that it was easy with the microscope to determine the sexes, from the different nature of the histological structure of the reproductive glands. The results of our examination are as follows: The males are abundant, and it seems probable that there is an equality in the number of individuals of the sexes. When about a foot in length, namely, when the eels are about a year old, there are no external structural differences, but at this period the males contain sperm cysts, sperm cells and immature (?) spermatozoa.

When the eels are from eighteen inches to two feet in length, in the autumn and early winter, the external sexual characters appear. This is confined to the style of coloration. No external structural characters could be detected, the form of the head, lips, body, fins and even the single genital pore being identical in the two sexes. In color the females are of a rich yellow on the under side, especially the long anal fin; the median line is silvery, but on each side there is a pale yellowish line. In the males the yellowish tint is entirely wanting, except on the long anal fin, the belly is dull silvery, and pigment spots are numerous beneath the head.

It is probable that the females are larger than the males, and when the ovaries are filled with ripe eggs, the body is a little more swollen than in the males.

The testis, as well as the ovary, is in the eel attached by one edge to each side of the intestine, and hangs vertically down in the body cavity. There is no oviduct, but the eggs or spermatic particles, as the case may be, drop directly by dehis-

cence into the body cavity, and pass out through a funnel-shaped fold of the peritoneum by a single small pore or opening identical in form and situation (just behind the anus) in each sex. There are not two openings, as has been stated by some authors. The testis does not differ in form and appearance from the ovary when the female is not in spawn, at least we could find no differences except that it is rather thinner. Both the right testis and ovary extend, in individuals about seventeen inches long, from about an inch and a quarter behind the vent, to near the diaphragm; extending on the right side to half way between the anterior end of the gall bladder and the diaphragm, while both the left testis and ovary are shorter than the right, ending an inch behind the diaphragm.

Microscopically examined the ovarian eggs lie in rows, with the stroma or tissue of fat cells between them. In the testis the spermatozoa are developed in sperm cysts, or "mother cells," much smaller than the ovarian egg (one-sixth to one-fifth mm). The mother cells contain a nucleus about one-third the diameter of the mother cell; in the nucleus is a dusky nucleolus about one-half the diameter of the nucleus. The sperm-cells are developed in the nucleus. They are nucleated, the nucleus large, and they (the sperm-cells) vary from $\frac{1}{10000}$ to $\frac{1}{30000}$ inch in diameter. The spermatozoa themselves are very minute, from $\frac{1}{500000}$ to $\frac{1}{200000}$ inch in diameter. They are active in their movements, the tail was indistinctly seen, but is present. It is doubtful in my mind whether a male eel when less than eighteen or twenty inches long, *i. e.*, when in its first year, is capable of fertilizing the eggs, as most of the spermatozoa noticed seemed not fully developed. In males twelve to fifteen inches long, *i. e.*, about one year old, the number of spermatozoa was much less than in larger, older individuals.

From information collected from persons living in Providence, it appears that the eels begin to descend the rivers and brooks of Rhode Island and Connecticut at the first frosts, when fishermen begin to catch them in eel-pots. They are in spawn in October, November and December, and probably through the winter, and they probably spawn in shallow salt and brackish water in harbors and at the mouth of estuaries and rivers, where it is well-known eels are speared in winter. That eels spawn in the autumn and early winter, and that the young soon hatch, seems proved by the fact that young eels from two to three inches long appear

in the spring, in April and May. I caught an eel at Providence, six inches long in October. It seems probable from this fact and the statements of others,[1] that by the last of summer and early part of autumn the eel hatched in late autumn or the winter attains a length of from six inches to a foot in length, and becomes from sixteen to twenty-four inches long the second year. It is well-known to all who have raised fish, or studied the embryology of animals, that individuals of the same brood may be accelerated or retarded in growth, so that eels a year old may vary greatly in size.[2]

In conclusion, so far as our observations extend, our common American eel descends fresh water streams into the salt water of harbors and estuaries, while those habitually living in the sea spawn at the mouths of rivers and in shallow harbors in the autumn and early winter, if not through the winter; the sexes only differ in color and in the histological structure of the reproductive glands, and do not breed until at least the second year. The eggs and spermatozoa are exceedingly minute, the former must be laid by millions; the young are two or three inches long in the middle or last of the spring, and the eel grows about an inch a month until maturity. It is desirable that these facts and inductions should be proved or disproved, and that the entire history of the breeding habits of the eel, hitherto so obscure, should be cleared up.

Since the preceding lines were written I have read Dr. Syrski's "lecture on the organs of reproduction and the fecundation of fishes and especially of eels" (1874), translated in the Report of the U. S. Commissioner of Fish and Fisheries for 1873–4 and 1874–5. The author gives an interesting review of the various and discordant opinions as to the breeding habits of the European

[1] Last June Mr. D. G. Colwell procured several thousand young eels and placed them in the mill pond. They were about two inches long at that time. Last Saturday, while working in the mill race, he caught one which was over seven inches in length, showing that they had grown about one inch per month since placed in the pond. In about a year from now we may expect good eel fishing in the Shiawassee.—*Quoted from Fenton Independent, Michigan, in Forest and Stream, Nov.*, 1878.

[2] For example, the small eel above referred to, about six inches in length, collected early in October, had not increased in size two months later; it has not been fed since its capture. As regards the food of eels, Mr. S. A. Simmons, Jr., of Providence, informs me that eels sometimes feed on the eggs of the king crab (Limulus), burrowing under the latter when spawning.

eel. It appears that Carlo Mundini first discovered the ovary of the eel in May, 1777; this was confirmed by Rathke, who described the eggs. Siebold (1863) states that eels may reproduce by parthenogenesis, or are hermaphrodite. In 1872 Ercolani claims to have found spermatozoa in eels, but Syrski is positive that he mistook them for "the molecular movement of the granules found so frequently in the tissues of the animal body." Whether Ercolani was right we have not at present the means of ascertaining, but think it more probable he was right than his critic, Syrski. In the same year (1872), Crivelli and Maggi, of Pavia, claim to have discovered, and have figured the spermatozoa. This memoir we have not yet seen. Syrski does not seem to endorse their statements. In 1874 Prof. Münter stated that he found ovaries in about 3000 eels examined for that purpose, but he never found a male eel, *i. e.*, a milter. He therefore admits that eels are reproduced by parthenogenesis, *i. e.*, from non-fecundated eggs, and remarks, "In all probability the eggs are deposited at the bottom of the Baltic sea from the middle of March to the middle of April, and the young eels, one-half to two inches long, born from such eggs, migrate into fresh water about the beginning of May."

Syrski then describes and figures the ovaries and "testes," as he regards them, of the eel. The "eggs" figured as such by him are certainly not such, but are the male sperm-cysts, and he has thus entirely mistaken the sex of the eel. He does not figure or describe the true ovarian egg or the ripe egg, which are, in the American eel at least, wholly different in their mode of development from Syrski's so-called eggs, and so different that we doubt not but that his females were really the males of the European species. He figures and describes a portion of what he regards as a testis, but gives no description of the mother-cells, sperm-cysts and spermatozoa; of the latter he says nothing. It is evident that this observer has been throughout mistaken, and has thrown little light on the subject.

To be sure that I have not been over confident in regard to this matter, after reading Syrski's article I have dissected another living male, and found the mother-cells, sperm-cysts and the exceedingly minute, free-moving spermatozoa, which were more abundant than usual in small males. I also reëxamined the ovary of a female not in spawn, and demonstrated them to Mr. J. S. Kings-

ley, who adopted the view that the bodies he saw could not have been anything else than spermatozoa. My friend, Prof. John Pierce, an experienced microscopist, several times with me examined the free moving spermatozoa (we saw hundreds in active motion), and agrees with me that the bodies we repeatedly observed from different males could not have been organic particles vibrating through the Brownian motion. We both, without distinctly observing the tails, witnessed effects that must have resulted from a rapidly vibrating appendage or "tail."

NOTE.—Since the above was written I have received (Dec. 12) from Mr. Vinal N. Edwards, of the U. S. Fish Commission, a number of eels from Wood's Holl, Mass., forwarded at the suggestion of Prof. Baird. There were two races or varieties among them, some dark with yellow on the belly, others light and silvery beneath, with the anal fin bright red, as well as the edges of the pectoral fins. I supposed that the yellow bellied ones were females and the silver bellied ones were males, but found males and females of both races; so that while the above remarks concerning the colors of the sexes may apply to what eels I examined from Providence River, in the Wood's Holl specimens, there was absolutely no colorational difference between the sexes, and the difference in color is probably due to the color of the water, and especially the nature of the sea bottom, whether sandy or muddy. The females from Wood's Holl were about ready to spawn, and the males contained more abundant spermatozoa than any others examined, but no milt.

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RECENT LITERATURE.

SARS' MOLLUSCAN FAUNA OF ARCTIC NORWAY.[1]—The connection between the northern faunæ of East America and Europe is so close that monographic work of any kind done for one region, deserves and usually obtains the careful attention of students whose field of research is in the other; and it is daily becoming more necessary as wider observation reveals with greater clearness the intimate relations which the two districts bear to one another. This is especially true of the marine animals, and therefore the appearance of Prof. Sars' important work on the Mollusca of Arctic Norway is an event of no little interest for the American student of northern invertebrates. The well known ability of the author as an observer, an investigator and an artistic delineator of the objects he describes, warrant us in expecting results, in the main, of the highest excellence. Yet candor compels us to admit that these expectations are only partly fulfilled.

The work contains a short introduction followed by a description of each species in zoölogical order, without synonymy or des-

[1] *Bidrag til kundskaben om Norges arktiske Fauna, I, Mollusca Regionis Arcticæ Norvegiæ.* Af Dr. G. O. SARS, Prof. Zoöl. v. Christiania Univ. Universitets program for förste halvaar 1878. Christiania, 1878. 8vo, pp. 466. Map and fifty-two autographic plates.

criptions of the genera, and with occasional but incomplete references to specific synonyms, followed by such remarks on each species as the wide experience gained by the author from eighteen years of study has suggested. The length of time over which the work has extended, has rendered a short supplement necessary to the main body of the book, which is followed by tables of geographical distribution and a discussion of the questions involved in this branch of the work, a full index, and the plates with their explanation. The text is in Norwegian and the descriptions of families and species in Latin.

The plates are autotypic and contain an amount of work which must be seen to be appreciated. It is true that a certain amount of progress may be traced in them, a few of the earlier ones being slightly less artistic than the rest, and an occasional correction will suggest itself to the special student, but aside from these inconsiderable matters, it may well be doubted if the animals of any other fauna have ever been so thoroughly and effectively treated by the pencil of a competent draughtsman. They are simply invaluable to the student of Arctic and boreal Mollusca, not only for their delineation of species (often unfigured elsewhere), but for the thoroughness with which accessories, too often neglected, such as dentition, opercula, anatomical details, etc., are represented whenever known. These plates alone would form for the author an enduring claim to the gratitude of his fellow naturalists of all countries.

A serious drawback, however, to the fullest usefulness of the work exists in its nomenclature, which does not appear to conform to any particular principles, and which most unfortunately adds very largely to the already overwhelming mass of synonymy with which this branch of science is loaded. Prof. Sars exhibits a tendency to divide species and genera to their fullest extent, and while this alone is not particularly reprehensible if carefully done, yet when done without great care, as in the present case, one may be pardoned for taking exception to the method, and lamenting the inevitable results. Thus we have as absolute synonyms of already established names, *Boreochiton* Sars (*Trachydermon* Crp.), *Boreofusus* Sars (*Troschelia* Mörch), and *Solenopus* M. Sars (*Neomenia* Tullb.) first described by Tullberg. *Craspedochilus* Sars, also belongs in a section first characterized and named by Carpenter. In this connection it may be mentioned that a reëxamination of the dentition of the Chitons would probably result in a revision of some of the figures. Of names which have been adopted without that search into their credentials which would have shown them to be untenable, a few may be mentioned. Such are *Portlandia* Mörch, *Tridonta* Schumacher, *Nicania* Leach, *Timoclea* Römer, *Rupicola* (*?*), *Antalis* Aldrovandus (*!*), *Delphinoidea* Brown, *Pilidium* Midd., *Pyrene* Bolten, and *Conulus* Nardo. Of names applied erroneously to forms which cannot by any

recognized rules come under them, there are quite a number, such as *Chiton* (restricted) for *Chiton hanleyi*; *Lepidopleurus* to *Chiton alveolus* M. Sars, *Nacella* to *Patina pellucida*, *Acmæa* (restricted) to *Collisella testudinalis*, while *Tectura* is retained for *Acmæa virginea*, *Scutellina* to *Pilidium fulvum*, *Ampullina* to *Bulbus Smithii*, *Chrysodomus* (as of Swainson) to *Fusus Turtoni*, while a typical *Chrysodomus* is called *Neptunea*, and so on. We are far from asserting that these blemishes are sufficient to condemn wholly a work which will always be of permanent value, yet it is impossible not to regret, that while the greater part of it is so very good the remainder was not brought a little nearer perfection. We presume the work, though not provided with a nominal publisher may be had of the author, or of the authorities of the University of Christiania. It was actually issued on the 6th of June, 1878, though proofs of part of the plates had been kindly furnished to several naturalists some time before their publication. —*W. H. Dall.*

Smithsonian Report for 1877.[1]—This report, the last made by the lamented Henry, contains matter of very general interest, not only as to the workings of the Smithsonian Institution but also the progress in the scientific explorations of the United States. Of particular value is the full "List of the more important Explorations and Expeditions, the collections of which have constituted the principal sources of supply to the National Museum, with indication of the department of the Government under which prosecuted." Besides the numerous articles in the appendix, translated and original, concerning archæology, physics and meteorology, zoölogists will be interested in the translation of Weismann's interesting paper "On the Change of the Mexican Axolotl to an Amblystoma."

Palæontological Report of the Princeton Scientific Expedition of 1877.[2]—This stout pamphlet represents the work of an expedition of students of Princeton College, who, under the auspices of Prof. Guyot, director of the museum of that institution, made an exploration of the fossiliferous beds of the Bridger Basin of Wyoming, and the fish-bearing shales of the South Park of Colorado. It is cause of congratulation on the part of the friends of scientific education, that the liberal endowment of this department at Princeton College should have commenced thus early to bear fruit, and in so profitable a direction. The seed sown by the late Mr. Green has evidently fallen into good ground, and we see at once the realization of President McCosh's view, that the great schools should not only be institutions for teaching,

[1] *Annual Report of the Board of Regents of the Smithsonian Institution . . . for 1877.* Washington, 1878. 8vo, pp. 500.

[2] *Contributions from the Museum of Geology and Archæology of Princeton College.* No 1, Palæontological Report, etc. By Henry F. Osborne, Wm. B. Scott and Francis Spier, Jr. Sept. 1, 1878. 8vo, pp. 146, pl. x.

but also furnish the facilities for the prosecution of original research.

The present report gives descriptions of the osteology and dentition of species of most of the leading forms of the Bridger Eocene fauna. These are, among *Mesodonta*, *Hyopsodus paulus*; *Perissodactyla*, *?Orohippus major*, *Palæosyops major* and *P. lævidens*; *Leurocephalus cultridens* gen. et sp. nov., *Amblypoda*, *Uintatherium leidyianum* sp. nov. and *U. princeps* sp. nov. The new species are *Megencephalon* (Carnivora new genus) 1 sp.; *Hyrachyus*, 3 sp.; *Helaletes*, 1 sp. *Ithygrammodon* gen. nov., supposed to be Artiodactyle and related to the *Camelidæ*, 1 sp. *Crocodilus*, 1 sp. Of the above, the most interesting novelty is the *Leurocephalus*, which is doubtless a genus distinct from *Palæosyops*, although the authors have not seized its single character in their diagnosis. The most beautiful specimen is the *Uintatherium leidyianum*, of which the party obtained a nearly complete cranium and much of the skeleton. The excellent heliotype engraving which accompanies the report gives a good idea of the appearance of this extraordinary animal, whose place is evidently between the two extreme forms, *Uintatherium mirabile* and *Loxolophodon cornutus*. Other figures representing vertebræ and other parts of the skeleton will prove very useful. Several of the other species are represented by figures engraved by photographic process. We can only wish for a few representing the crowns of the teeth.

The fish-beds of Florissant, Col., yielded some fine specimens of several species, among which is a new *Trichophanes*.

The authors of this catalogue may congratulate themselves on having measureably mastered one of the most difficult branches of our palæontology, considered from the standpoint of literature and synonymy. They have presented the results of their labors in a form which is available to their fellow workers. We conclude this notice with the single regret that they did not retain in MS. the compiled catalogue which closes the report. There are several reasons why this course should have been followed; one of which is that a large proportion of its names are as yet without authority, but are rather in the condition of those that fill sales catalogues of different kinds, than available for scientific purposes.

PACKARD'S GUIDE TO THE STUDY OF INSECTS.[1]—We notice the present edition for the purpose of drawing attention to certain changes and suggestions which may prove of interest to those who do not possess the last edition, and for this purpose quote as follows from the preface. "More important additions and alterations have been made in this edition than in any previous one. The author has decided to consider the Hexapoda, Arachnida

[1] *Guide to the Study of Insects and a Treatise on those injurious and beneficial to Crops.* For the use of Colleges, Farm-schools and Agriculturalists. By A. S. PACKARD, Jr., M.D. With fifteen plates and six hundred and seventy wood-cuts. Sixth edition. New York: Henry Holt & Co. Boston: Estes & Lauriat. 1878, 8vo, pp. 715.

and Myriopoda as sub-classes of Tracheata, and consequently what have been in former editions regarded as sub-orders are called orders. The Thysanura, moreover, are separated from the Neuroptera and regarded as a distinct order, comprising synthetic types with features allying them to the Orthoptera, Neuroptera and Myriopoda. They are divided into two sub-orders, the lower the *Collembola* of Lubbock, and for the higher sub-order, comprising the Lepismatidæ and Campodeæ, the term *Cinura* (κινεω, to move; ουρος, tail) is proposed. The terms *tenaculum* and *elater* are adopted from the author's previous writings for the "holder" and "spring" of the Collembola; and for the sucker, or organ secreting the adhesive material characteristic of the Collembola, the term *collophore* is proposed.

"Brief mention has been made of the *Pycnogonidæ*, which are placed among the mites; also of the Peripatidæ, which are given a place next to the sucking Myriopoda, since they have been proved by the researches of Mr. Moseley to be Tracheata"

THOMAS' NOXIOUS INSECTS OF ILLINOIS.[1]—This voluminous report evinces the activity shown the past year in Illinois as regards the prevention and cure of injuries from injurious insects. The State entomologist has employed Prof. G. H. French as general assistant, Miss Nettie Middleton as office assistant, and Miss Emily A. Smith as special assistant for the north-western part of the State. Over a hundred pages are devoted by Prof. Thomas to insects injurious to corn; an excellent report by Miss Smith relates also to corn insects and to the maple-tree bark-louse, while the second half of the report is devoted by Prof. French to a description of the butterflies and moths, with their caterpillars, especially injurious in Illinois. The volume is well calculated to interest and instruct the people of the West in economic entomology, and, we think, is an improvement on last year's report.

LOCKYER'S GUILLEMIN'S FORCES OF NATURE.[2]—By its general accuracy of statement, simplicity and clearness of style, and the excellence of the wood-cuts and full page illustrations, this work in its English dress, will commend itself to those naturalists who wish to broaden their field of study and to ascertain the nature of the environment by which the life of the globe is surrounded. From many points of view the naturalist and geologist will need to review and utilize his knowledge, or if that be wanting, acquire some idea of the physical phenomena of nature.

[1] *Seventh Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois. Second Annual Report.* By CYRUS THOMAS, Ph.D., State Entomologist. Springfield, Ill., 1878,. 8vo, pp. 290.

[2] *The Forces of Nature.* A popular introduction to the study of Physical Phenomena. By Amédée Guillemin. Translated from the French by Mrs. NORMAN LOCKYER, and edited with additions and notes by J. NORMAN LOCKYER, F.R.S. Illustrated by nearly five hundred engravings. London, Macmillan & Co., 1877. 8vo, pp. 725. 18 numbers, one shilling a number.

The work after having had, as the English publishers claim, an "enormous circulation" in France, and two very large editions in England, is republished in England in eighteen parts, "at about half the original cost." It is divided into seven books, treating of gravity and attraction, sound, light and color, heat, magnetism and electricity, the rainbow, the rise of clouds and fogs, and atmospheric meteors, with a full index. A brief appendix contains the reprint of a paper by Prof. Henry Draper on the discovery of oxygen in the sun by photography, and a new theory of the solar spectrum.

LETTER FROM O. C. MARSH, ETC., TRANSMITTING THE REPORT ON THE SCIENTIFIC SURVEYS OF THE TERRITORIES, ETC.[1]—We have received a copy of this document, which consists of the report of a committee which was appointed by Prof. O. C. Marsh under the following circumstances: Certain persons, not friendly to some of the U. S. Geological Surveys as at present constituted, succeeded in having included in the Sundry Civil Appropriation Bill, of June 30, 1878, the following clause:

"And the National Academy of Sciences is hereby required, at their next meeting, to take into consideration the methods and expenses of conducting all surveys of a scientific character under the War or Interior Department, and the surveys of the Land Office, and to report to Congress as soon thereafter as may be practicable, a plan for surveying and mapping the Territories of the United States on such general system as will, in their judgment, secure the best results at the least possible cost; and also to recommend to Congress a suitable plan for the publication and distribution of the reports, maps and documents, and other results of said surveys."

In pursuance of this act, Prof. Marsh, who is acting president of the Academy, pending the appointment of Prof. Henry's successor, selected a committee consisting of six gentlemen who were not personally connected with the surveys. Of the seven members of the committee, four were geologists, of whom the two younger and more capable members were known to desire changes in the personnel of some of the surveys. In accordance with the constitution of the National Academy, a committee may be appointed in the interval of the meetings, in response to a request of Congress, and such committee is not required to refer to the Academy for advice and assistance, but reports its conclusions to Congress direct, and its proceedings to the next meeting of the Academy. It is evident that reports made in this way lose much of their authority as utterances of the Academy, especially when, as in the present instance it has just been deprived of its president and has not yet secured the services of a successor.

[1] *Letter from O. C. Marsh, vice-president and acting president of the National Academy of Sciences, transmitting, in obedience to law, the Report on the Scientific Surveys of the Territories made by the Nat. Academy of Sciences.* Senate Mis. Doc., No. 9.

The report of the committee makes three recommendations; as follows: First, that the geodetic surveying of the Territories of the United States be placed in the hands of one organization, and that that one be the United States Coast Survey, which they also propose shall be transferred to the Interior Department. Secondly, that all of the existing geological and geographical surveys be abolished, and that a new organization be created under the Interior Department, to be called the United States Geological Survey. Thirdly, the limitation of the duties of the Land Office to questions relating to the disposition and sale of public lands, their titles, the records, etc.

At first sight there is a simplicity and harmony about the plan thus recommended, which is pleasing to one's sense of order and fitness. The proposition for the unification of all geodetic work is every way reasonable, and we hope to see it adopted. So, also, with the plan of conduct of the Land Office. But as regards the geological work proper of the country, there is no such reason for consolidation. If the work be well done, it matters not to how many organizations it be confided, provided it be not duplicated, and of this there is now no danger. In fact, in view of the utter absence of reasonable grounds for the committee's proposition on this head, we seek for the presentation of some in the report, but in vain. We have now three or four extensive and complex organizations fully equipped at great expense, and ably manned, all doing work which is the admiration of the older countries, as well as of our own, which this committee proposes to snuff out of existence. And this while they are in the midst of their usefulness, and preparing to bring out work which is the result of years of preparation. The proposition seems especially absurd in view of the other fact, that the term of existence of Government supervision of this work is, at most, limited. One portion after another of the territory west of the 100th meridian will be entering the Union as States, and then the sustenance of the geological surveying will fall to the State Governments. It does, therefore, seem particularly unnecessary to create a new body for this object at this time. We can only account for the proposition in view of the universal truth that "some men labor, and other men enter into their labors."

The following summary includes the more important objections which occur to us:

(1.) The surveys as they now exist are the results of private effort and energy, and the force of personal interest on the part of their directors is an important element in their success. Remove this, and much of their working power is gone.

(2.) The territories will, before many years, become States, and the services of the General Government in surveying will be superseded by the State Govenments. It is therefore unnecessary to create a new organization to accomplish a work which is

now in large part completed, and for which competent organizations already exist.

(3.) The present organizations are abundantly capable of doing the work, in the opinion of competent critics in America and Europe.

(4.) The existence of several distinct organizations is a guarantee of better work than where but one exists. The emulation which exists between different surveys, and the constant necessity for preserving each other's respect, secures a high standard of work, and prevents the development of a Beaurocracy which is foreign to our methods and tastes.

(5.) The objection raised on account of the duplication of work, ceases to exist with the proper division of territory between the Surveys.

(6.) No department of the U. S. Government should be precluded from entering on any geological or other scientific work germane to its objects.

(7.) The more numerous the surveys, the more numerous the avenues of publication of scientific work, an advantage highly appreciated by the savants of the country.—*E. D. Cope.*

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Tenth Annual Report of the U. S. Geological and Geographical Survey of the Territorities, embracing parts of Colorado and adjacent Territories, being a report of progress for the year 1878. By F. V. Hayden, U. S. Geologist. Washington, Dec. 15th, 1878, pp. 546.

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GENERAL NOTES.

BOTANY.

Association of an Inconspicuous Corolla with Proterogynous Dichogamy in Insect-fertilized Flowers.—Mr. A. S. Wilson, at the last meeting of the British association, read a paper on this subject. He said that there is a class of flowers represented by the common figwort (*Schrophularia nodosa*) which are shown, by their secreting nectar and emitting odors, to be dependant on the visits of insects for their fertilization, and not on the wind, and yet do not possess a conspicuous colored or marked corolla for the guidance of insects to the flowers. Moreover, the flowers are in them not massed together to gain additional conspicuousness, as in highly colored flowers, like heaths, foxgloves, gladiolus, etc. Highly colored conspicuous flowers are usually proteranhous, *i. e.* the anthers are matured before the stigma, and as flowers are usually developed from below upwards, it follows that in any given plant the lower flowers will have shed their pollen and have their

stigmas ready to receive it by the time the upper flowers are beginning to shed their pollen. In this inconspicuous class, on the other hand, the lower flowers will be in the second or male stage when the upper flowers are as yet in the younger or female stage. Now it is clear that an insect visiting such flowers, must adhere to the habit of the bee, which invariably begins at the lower flower on a stalk and goes upwards, taking each flower in regular succession. By this means it invariably enters first a female flower and there deposits the pollen it brings with it from another plant. Were the bee to reverse this order, the whole elaborate arrangements of many plants for cross-fertilization would be upset, for the bee would simply transfer pollen from the upper male flowers and deposit it on the lower female ones. This would be fertilization by flowers of the same plant, and this Mr. Darwin has shown to be little or no better than self-fertilization. In the case of the inconspicuous flowers, where the opposite condition obtains, a bee would frustrate fertilization by adhering to its ordinary ascending habit. Mr. Wilson's observations of a wasp visiting these plants indicate that the wasp begins at the top flower and proceeds downwards—so that they are adapted specially to such insects, and as wasps are generally predatory in their habits, and not entirely vegetable feeders, as bees are, it is probable that, like other carnivorous creatures, their perceptions of vision and scent are keener; hence wasps can probably find these obscure flowers quite as easily as a bee can a highly-colored one. The plant, therefore, finds that the material can be more economically utilized than in the production of a colored corolla just as in the case of self-fertile cleistogamic flowers.

Botanical News.—At the last meeting of the British Association Mr. A. S. Wilson read some notes on dimorphic plants. The plants referred to in this paper were *Erythræa centaurium*, which appears from a microscopic examination of the pollen to be a dimorphic plant like the primrose or bog-bean; and *Silene acaulis*, which presents three forms—a male, having stamens only, a female, with rudimentary stamens and perfect pistils, and a perfect hermaphrodite form, having both complete. In this respect it resembles *S. inflata*, which, according to Axell, is triœciously polygamous.

Mr. Wilson also remarked on "Some Mechanical Arrangements Subserving Cross-Fertilization of Plants by Insects." This paper had reference to the three plants, *Vinca minor*, *Pinguicula vulgaris*, and foxglove—and was a description of latch-like arrangements in the latter two, and a knee-shaped bend in the first, which when depressed by an insect entering the flowers, cause the pollen to be deposited on the insect, and, in the case of *Vinca*, to smear the pollen with viscid matter from the circumference of the curiously-shaped disc forming the lower part of the stigma.

Dr. Bayley Balfour referred to certain peculiarities in the struc-

ture of the *Naiidaceæ*. He especially described the arrangement of leaves in the genus *Helophila*. In this marine tropical phnæogam, the stem is a creeping jointed rhizoma; at each joint occurs a pair of sheafing scale leaves. No foliage leaves occur on the main axis. In the axil of one scale leaf of each pair arises eccentrically a lateral secondary shoot, which is a jointed rhizoma like the parent, and the first pair of leaves upon it is a pair of foliage leaves, the succeeding leaves on this axis are all scale leaves. From these secondary axes tertiary ones arise, which again repeat the process. Thus the foliage leaves in these plants only occur as the first pair of leaves on the lateral shoots. This is probably unique in the vegetable kingdom. The homologies of the parts of the male and female flowers were also pointed out.

The *Bulletin* of the Torrey Botanical Club for October (which was late in coming) contains several notes by Messrs. Eaton, Underwood and Gilbert, on the ferns of the United States.

In the *Botanical Gazette* for November, Fendler's Ferns of Trinidad are noticed by Prof. Eaton. The leaves of *Darlingtonia californica* and their two secretions are described by Mrs. R. M. Austin.

ZOÖLOGY.[1]

On the Origin of Bilateral Symmetry and the Numerous Segments of the Soft Rays of Fishes.—As is well known, the soft fin-rays of *Acanthopterous* fishes and all or most of the fin-rays of *Malacopterygians*, are composed of two bilaterally symmetrical ossified and more or less completely segmented halves, semicircular in section, each having a groove on its inner face to receive between them a cartilaginous medulla. Their embryological history shows that the process of ossification is progressive from without inwards, or in the language of recent authorities it may be styled ectosteal.

Viewed in a non-teleological, or in the light of what seem to be the probable mechanical (dynamical) differentiating causes, their origin becomes extremely simple. No type of vertebrate limb has such exceedingly short and numerous segments in relation to its total length. In extreme contrast with them we may place the digital wing-elements of the *Chiroptera* and *Pterosauria*, and of these it may be said no vertebrate types exhibit such excessive elongation of the digital elements in proportion to their aggregate length. Contrasting their habitual modes of use in relation to their surroundings, we find the media, water and air, in which the two, respectively fins and wings, are used differ as widely in respect to density. That such difference in structure should accompany such widely differing conditions would seem to be caused by those conditions. Then, like those types which perambulate over approximate planes, there are no definite points of im-

[1] The departments of Ornithology and Mammalogy are conducted by Dr. Elliott Coues, U. S. A.

pact, hence we find no specialization of structure for counteracting, or rather for preventing injuries which such impacts might cause, as we find in hoofs, corneous pads or soles, nails and claws, but the whole impinging surface of the osseous supporting structure is differentiated or developed in degrees; in general terms it is most developed proximally and gradually shades off, becoming least developed distally. Again, in the fish but little osseous tissue is found developed anywhere except in opposition to the lines of greatest mechanical resistance encountered in locomotion, so that paradoxical as it may appear, it looks as though the means of locomotion have actually been cumulatively and phylogenetically developed by the means used to effect the movements. In this way we may probably explain the bilaterally symmetrical disposition of the osseous part of the soft rays which are thickest where the resistance is theoretically the greatest. On the other hand, the volant types, which are provided with interdigital alar membranes, have their bones of the ordinary type, that is, ossified alike on all sides, hence essentially tubular; in the *Pterosauria* the walls of the tubular digital bones are very thin but dense, which is in agreement with the requirements of their environments and is probably caused by them.

As a non-teleological summary the following principles are derived:

1. In proportion to the degree of resistance or density of the medium traversed, do osseous segments tend to be abbreviated and *vice versa*. (This tendency is only overcome by means of relatively great muscular specialization, as in the long-limbed Anourous Batrachians and Ungulate Mammals, but even here the remote impinging elements tend to become shorter.)

2. The tendency to the development of osseous structure in the lines of greatest resistance seems to be an invariable phenomenon attending the exhibition of vertebrate life on our planet, and in this way bilateral symmetry of the osseous halves of soft fin-rays is accounted for, and on the self-evident assumption that the rythmical efforts exerted in opposite directions in overcoming inertia are potentially alike, the morphological effects tending from this cause to be repeated on opposite sides of a part or the whole of the body as the case may be. The general truth that bone is developed ecto-chondrially is accordingly in large part explained.

The segmentation of limbs, of the notochord of arthropods, etc., into series of phalanges, vertebræ, osteomeres, neuromeres, myomeres, renomeres, antimeres, somites, etc., becomes clearly subordinate to the foregoing.

It will be apparent to those familiar with a sufficiently great number of animal types and structural features that the above, when taken together with the doctrine universal of mutual retroactivity existing between living forms and their environment, will explain away deductively the origin of a great majority of the

morphological features of those living forms. A so modified Lamarckian philosophy of animal differentiation seems reasonable, and a most overwhelming mass of evidence exists in its favor; varieties, species, genera, etc., presenting only the milestones, as it were, of the great non-teleological and universal process of evolution by means of knowable and discoverable causes originating in the mechanical and dynamical conditions which surround living organisms, and by which they are related to the cosmos. This, however, goes without saying, that types may not be more or less persistent from the persistence of a uniformity of conditions.—*John A. Ryder.*

Some New Points in the Construction of the Tongues of Woodpeckers.—The tongue of the woodpecker is long, flat, horny, and at its end armed with a number of short barbs. By means of a peculiar mechanism it can be suddenly pushed out, so as to reach far beyond the point of the bill. The two cartilaginous appendices to the hyoid bone, known as "the horns," are curved into wide arches, each horn making a loop down the neck, and thence bending upwards, sliding around the skull down on the forehead. Through a peculiar muscular arrangement of the sheaths, in which the horns slide, they can be retracted down on the occiput, and will then work as springs on the base of the tongue, forcing it out with great velocity. These peculiarities in the construction of the tongues of woodpeckers have long been known, and the above description is pretty nearly the same as that given by Claus in his "Grundzüge der Zoologie."

The skull of *Gecinus viridis* L., showing the asymmetrical position of the horns (cornua linguæ) and their extension through the nasal fossa to the end of the cavity covered by the intermaxillare.

Some years ago I was engaged in Sweden, in preparing zoötomical specimens, among which were some woodpeckers' heads, viz: one *Picus tridactylus*, two *P. martius* and more than twenty *P. viridis*.

In every one of them I noticed a peculiar *asymmetric arrangement* of the horns, which, upon reaching the upper part of the skull, met in a broad groove of its surface, and following the groove, are turned towards the right side of the forehead, running down between the right orbit and the crest, which is raised along the median line of the lower part of the forehead, slightly inclined towards the right side.

In *P. tridactylus* aud *P. martius* I found that the horns end above the base of the forehead. But in *P. viridis* they extend through the nasal fossa into the cavity, which is covered by the

os intermaxillare, their ends reaching all the way out to the extreme end of the said cavity.

Since that time I have had no opportunity of making further investigations in this matter. It seems probable that such an arrangement as found in the tongue of *P. viridis* would enable the bird to project its tongue further and with greater velocity than those that have shorter horns. Therefore I would suppose that *P. viridis* feeds on larvæ which live in the deeper parts of the wood and are quick in their motions. This, however, I must acknowledge to be merely a supposition, but it is a point worthy of the attention of zoölogists.—*Dr. Josua Lindahl.*

Amphioxus and Lingula at the Mouth of Chesapeake Bay.—In his account of a foundation of a zoölogical laboratory at the mouth of Chesapeake bay, as a summer school of instruction for the students of John Hopkins University, Prof. W. K. Brooks, in the third Annual Report of the University, thus speaks of the scientific results of the summer's work, and of the discovery of the early stages of Amphioxus and Lingula. We shall elsewhere notice the workings of this laboratory :

"The amount of advantage which zoölogical science can derive from the discovery and description of new species is very slight as compared with that which is gained by the careful study of the whole life-history of any form of life—old or new. As this work can be done only where the living animals can be had, it is properly *laboratory* work, as distinguished from *museum* work, or the identification of species.

"I accordingly made no attempt to find and describe new forms, but devoted all our time to the careful study of a few important species ; selecting for this purpose, from among those which were abundant at our station, the ones a knowledge of which is most desirable to science. I may say, however, that two of the forms which we selected for careful study were new additions to the fauna of this region. One of these, *Amphioxus*, was studied by Mr. Rice. *Amphioxus* is a small worm-like animal, the lowest of the vertebrates, and it is of very great scientific interest, since it has preserved many evidences of a relationship to various groups of invertebrates, and thus serves to bridge over the gap which was supposed by Cuvier and Agassiz to separate the vertebrata from all lower forms of life. Its embryology, which may be termed the key to the embryology of all the higher animals, has been ably studied by several of the most distinguished zoölogists of Europe, and a number of papers have appeared upon the subject within a few years. We fortunately found several larvæ which had passed beyond the stages studied by these naturalists, but which had not yet acquired the adult characteristics. Mr. Rice succeeded in keeping these alive, and was thus able to supply the information necessary to complete our knowledge of its development. He also made very interest-

ing observations upon the habits of *Amphioxus*. *Amphioxus* has been found upon the coast of North Carolina, and last winter one of the assistants of the Smithsonion Institution discovered it in the Bermudas; until this summer these were the only instances of its occurrence upon this side of the Atlantic.

"Another important form of life which was carefully studied, is *Lingula*, one of the Brachiopods, a group which has been of great importance during past geological periods, but has now almost entirely disappeared. *Lingula* itself has persisted unchanged from the time of formation of the oldest fossiliferous rocks, and is one of the first living things of which we have any knowledge. As *Lingula* has not before been found under circumstances which admitted of careful study, almost nothing was known of its development, but I was able to trace its life-history this summer from a very early stage up to the adult form, and to show that, old as it is, each individual, from the time of the lower Silurian up to the present time, has transmitted to its children a developmental record which proves that *Lingula* itself is the descendant of a much older form."

Singular Habit of a Meloid Beetle.—I have noticed for the past two seasons a singular habit of one of the Meloid beetles, *Tricrania stansburii*, which, so far as I am aware, seems somewhat at variance with the known habits of this family. Previous to the spring of 1877 this beetle was very rarely taken, and is yet, I believe, not common in collections. In April of that year a few were caught on the Kansas plains, slowly flying over the uplands on warm sunny days. In the latter part of the month, however, a number of specimens were observed in the bottom of a wagon bed that had been used to collect buffalo bones for the market; upon further investigation large quantities were obtained from the decaying buffalo and antelope bones on the high prairies. They chose only the cancellous tissue of the limb bones, or more especially the ethomidal and sphenoidal regions of the skull in weathered skeletons. None were ever taken after the latter part of May. In early May of the present year several were taken from a decayed railroad tie in the vicinity of Como, Wyoming; one female having apparently just deposited a mass of eggs in a warm fissure.

The large number upon the plains, both of species and individuals, in this genus, together with *Meloe*, *Nomaspis*, *Macrobasis*, *Epicauta*, *Pyrota*, *Zonitis*, *Nemognatha* and *Gnathium*, and the parasitism of several of these, as shown by Prof. Riley, upon the locusts, will render a further elucidation of the habits of *Tricrania* an interesting one.—*S. W. Williston.*

New Carcinological Papers.—Mr. E. J. Miers, of the British Museum, publishes a "Revision of the Hippidea" in the Journal of the Linnæan Society, Vol. xiv, in which he enumerate six

genera and twenty-two species from the whole world. This author rejects Dana's view of placing these Crustacea immediately beneath the Corystoidea, but would rather follow Lamarck and Milne Edwards and connect them with the Oxystomatous Crustacea through the family Raninidæ.

These Crustacea are represented on our coast (south of Cape Cod by *Hippa talpoida* Say, which our author is inclined to consider the same as *Hippa emeritus* of Fabricius (*Cancer emeritus* L.).

A second paper by the same author on a collection of Crustacea from the Gulf of Akabo, at the northern extremity of the Red Sea (Annals and Mag. Nat. Hist., Nov., 1878), has some interesting remarks upon some species of the difficult genus Trapezia. —*J. S. Kingsley, Providence, R. I.*

Mode of Drinking of the Red Squirrel.—In a late camping excursion in the wilderness of Wisconsin, on the Upper Manominee, we frequently met the common red or Hudson's bay squirrel (*Sciurus hudsonius*) swimming the river, when they were easily taken into the canoes. Several of the ladies of the party interested themselves by confining the squirrels in boxes, and then feeding and watering them; in most cases they gnawed their way out and were gone the next morning, but not all. They were observing girls, and a discussion soon arose among them, whether the squirrels drank water by the sucking or by the lapping process, which was finally referred to me for decision. Miss H. had one which had already become quite domesticated, and would come at her call to eat and drink, which was done through a small orifice not large enough to admit the passage of the whole head. A little triangular cup was formed of a leaf and filled with water, and one angle presented to the opening and the squirrel called. He instantly came, projected his nose out about half an inch to the water and commenced drinking. This, beyond all doubt, was done by lapping up the water, as is the habit of the dog and the cat, but the process was so exceedingly rapid as to require a very careful scrutiny to detect it with certainty. The position was very favorable for accurate observation, and the point was finally yielded by the doubters.

This may be familiar to naturalists, but I do not remember to have observed any examination as to the modes in which the various quadrupeds drink, nor had the subject previously occupied my attention. Do all the rodents lap their drink like the dog and the cat families? Has any naturalist undertaken to settle the question as to what quadrupeds drink by lapping and what by sucking the water? It seems to me that these are characteristics of scientific importance, and worthy of attention.—*J. D. Caton, Ottawa, Ills.*

Cand. Robt. Collett, of the University of Christiania, has lately published a list of Norwegian Zoölogical literature for 1877, of which the following is a summary:

R. Collett, "On *Myodes lemmus* in Norway." Some remarks on the migratory habits of the Norwegian lemmings (Journ. Lin. Soc. Zoöl. Vol. xiii., pp. 327–334). *Id.*, three papers containing contributions to the Ornithology of Norway (Proc. Zoöl. Soc., Lond., 1877, pp. 43–46; Nyt Mag. f. Naturv. Vol. xxiii, No. 4, pp. 85–225; and Forh. Vid. Selsk. Christiania, 1877, No. 5; pp. 4). *Id.*, a synopsis of fifty-nine species of birds from Madagascar and Bourbon, presented to the Christiania Museum (Forh. Vid. Selsk. Christiania, 1877, No. 6; pp. 20).

J. Koren and D. Danielsen, descriptions of six new species of the gastropod tribe *Solenopus* M. Sars (Arch. f. Math. Naturv., Vol. ii, No. 2, pp. 120–128).

H. Friele, "Preliminary report on Mollusca from the Norwegian North Atlantic Expedition in 1876," with one autograph plate (Nyt Mag. f. Naturv., Vol. xxiii, No. 3, pp. 1–10). *Id.*, a paper on the radula of Norwegian *Rhipidoglossa*, with four autograph plates (Arch. f. Math. and Naturv., Vol. ii, No. 2; pp. 217). *Id.*, "The development of the skeleton in the genus *Waldheimia*," with six lithograph plates (Arch. f. Math. and Naturv., Vol. ii, No. 4, pp. 380–386).

J. Sparre Schneider, a report on the Lepidoptera collected by the author near Drammen in 1876 (Forh. Vid. Selsk. Christiania, 1877, No. 4; pp. 30).

H. Siebke, "*Enumeratio Insectorum Norvegicorum. Fasc.* iv, *catalogum Dipterorum continens.*" Ed. J. Sp. Schneider. 255 pages (University programme, 1877).

V. Storm, a report on the Museum of "Videnskabernes Selskab," and some notices of rare Coleoptera, found around Drontheim (Det Kgl. N. Vid. Selsk. Skr. i 19 Aarh., Vol. viii, No. 4; pages 131–162).

G. O. Sars, on the *Mysidæ* of the Mediterranean, with thirty-six autograph plates (Arch. f. Math. and Naturv., Vol. ii, No. 1, pp. 10–119). *Id.*, *Prodromus descriptionis crustaceorum Pycnogonidarum, quæ in expeditione Norvegica, anno* 1876, *observavit* (Arch. f. Math. and Naturv., Vol. ii, No. 3; pp. 237–269).

D. Danielson and J. Koren, a synopsis of the *Echinodermata*, collected in the Norwegian expedition to the North Atlantic, in 1876. Several new species, among them one crinoid, *Iycrinus carpenterii*, from a depth of nearly 1500 fathoms in a temperature of — 1.6° C; three lithograph plates (Nyt Mag. f. Naturv., Vol. xxiii, No. 3; pp. 45–83).

J. Koren and D. Danielsen, "Fauna littoralis Norvegiæ," Part III, with sixteen plates, pp. 163, folio. Bergen, 1877. This volume forms the third part of the important work, of which the first part was published in 1846, by the late Prof. M. Sars, and the second in 1856, by M. Sars, J. Koren and D. Danielsen. The third part contains seven separate papers, viz.: 1. New or little known *Cœlenterata*, by M. Sars; ed. G. O. Sars. 2. New *Echinodermata*,

by M. Sars; ed. G. O. Sars. 3. New Norwegian *Cœlenterata*, by Koren and Danielsen. 4. Norwegian *Pennatulidæ*, by Koren and Danielson. 5. New *Bryozoa*, by Koren and Danielson. 6. Norwegian *Gephyrea*, by Koren and Danielson. 7. A new species of the genus *Pennella*, by Koren and Danielson.—(*F. L.*).

ANTHROPOLOGY.[1]

ANTHROPOLOGICAL NEWS.—Dr. George A. Otis, the curator of the U. S. Army Medical Museum, writes the following with reference to the work done at the museum under his charge: "Since January 1, 1878, Section IV, of the Army Medical Museum, has received specimens numbered from 1830 to 1952, inclusive, and comprising skeletons, crania and calvaria of American origin, with the exception of fifteen New Zealand calvaria transmitted from the Smithsonian Institution. These specimens have been carefully prepared, numbered and mounted; the principal measurements, in each case, made and recorded. Among the additions to the complete skeletons of American Indians was a series of seven Sioux, exhumed by Assistant Surgeon Corbusier; specimens from the shell-heaps of Florida, from Colorado and from Tennessee, of supposed pre-historic date, are of especial interest." The immense amount of work required by the Medical History of the War has exhausted all the funds appropriated for this institution. But Dr. Otis, with his trained assistants, has measured and mounted every important cranium which he has received, and has reconstructed from fragments many pre-historic skulls, an art in which he is exceedingly skillful. As soon as time and funds will allow, the results of these measurements will be laid before the scientific world.

The Rev. S. D. Peet, editor of the *American Antiquarian*, sends us his Prospectus, and it gives us great pleasure not only to draw attention to it, but to urge upon all lovers of American archæology to make sacrifices to sustain it Mr. Peet, without State or Government patronage, has for years given his leisure freely to aboriginal history. It is due to him as well as to the subject which we love in common, that he be not left alone in the matter. The brilliant success achieved in anthropology in England and Germany, but most of all in France, is due mainly to the interest awakened by the periodicals devoted solely to this one subject. The advantage of a special organ ever disseminating our efforts throughout all the periodicals of the country is apparent to all. Mr. Peet's address is at present Unionville, O.

The New York *Herald*, of November 5th, contains a review of Col. Mallery's paper on the supposed decrease in the number of our aborigines. Having once drawn attention to this paper, our space and our duty to the truth will not allow us to refer to it again, lest mistaken zeal rob the truth of its reward. Col. Mal-

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

lery meant to say, and did say, that the Aborigines of America have been overestimated in numbers, that many tribes have been partly or wholly destroyed by whisky, disease and persecution, that others, after the first shock of contact, had continued to increase, and that, on the whole, there is not much difference between the present number of Indians and that of the "Discovery." The main argument of Col. Mallery was to show that, since the "necessary withering before the white man" is a fallacy, all efforts to help him to destruction are cruel and unpardonable.

We take great pleasure in recording the discovery of a large obsidian quarry, the largest yet found in America, in the Yellowstone National Park. Near the head of the middle fork of Gardiner's river, in the north-western part of the park, deposits of this rock nearly 600 feet in thickness and of unknown horizontal extent, were found. The discovery is reported by Mr. W. H. Holmes, assistant geologist of the Hayden Survey, who reports the finding of whole and broken implements, flakes and cores in great abundance.

In the November number of *Science News*, Dr. C. C. Abbott gives some valuable hints to collectors how to proceed in order to realize the full benefit of their work. Such cautions are exceedingly timely, coming from one who has devoted so much time in obeying his own instructions.

Dr. Emil Schmidt, of Essen, contributes to Archiv für Anthropologie, 1878, Parts 1, 2, an article of forty-two pages, on the pre-historic copper implements of North America. The article is illustrated by three plates and fifty-three figures, and is abundantly furnished with foot notes referring to the best authorities on the subject.

Through the kindness of Prof. J. Duncan Putnam we are in receipt of advanced sheets of the forthcoming Proceedings of the Davenport Academy of Natural Sciences. Quite a large portion of the volume is devoted to a description of Mound excavations by Messrs. Pratt, Gass, Palmer and Harrison. Mr. W. W. Calkins read a paper, Feb. 28th, on the Shell-heaps of Florida.

Prof. Ph. Valentine has published Vortrag über den Mexicanischen Calender-stein, gehalten am 30 April 1878, in Republican Hall vor dem Deutsch ges. wissenschaftlichen Verein. New York, 1878.

Mr. G. Laurence Gomme, honorary secretary of the English Folk Lore Society, has written to the secretary of the Smithsonian Institution asking coöperation in carrying out the aims of the society. Perhaps there is no country where the facts of primitive culture are so easily accessible as our own. In addition to the fertile field offered by our aborigines, we have the negroes of the South, and the myth-preserving peasantry transported to our shores from all the lands of the earth. The NATURALIST will be

foremost in encouraging this as it has been with other branches of anthropological study.

The first number of Vol. viii, of the *Journal* of the Anthropological Institute of Great Britain and Ireland, dated August, is an unusually interesting brochure. The paper which will prove most interesting to the general student is "On the coloring matter found in human hair," by H. C. Sorby. The author is begged to reconsider his statement that black hair is not made lighter by direct sunlight. Our black horses at the South all become a dirty brown color in August, and many will recall the foxy red hair of the little negroes that greeted the traveler at every wayside before the late war. Mr. W. St. Chad Boscawen makes a communication upon the Primitive culture of Babylonia, which reviews the evolution of the cuneiform writing. Other papers are: On the original range of the Papuan and Negrette races, by Francis A. Allen; The spread of the Slaves, Part 2, by H. H. Howorth.

The first and second quarterly parts of *Archiv für Anthropologie* for 1878, come at the same time. The paper on pre-historic copper implements of North America has already been noticed. The following titles may have some interest to special students: Upon the value of the frontal process (*spina frontalis squamæ ossis temporum, Stirnfortsatz der Schläfenschuppe*) as a race characteristic, by Dr. Ludwig Stieda; Upon the problem of the origin of marriage; Communications at the sessions of the Society of the Lower Rhine, by Prof. Schaafhausen; C. Von Baers' anthropological and geographical writings, by L. Stieda; Upon measuring and fixing the horizontal of the skull, by Prof. Schaafhausen. Bound up with *Archiv* are Nos. 9, 10 and 11 of *Correspondenz-Blatt*, giving a full account of the general meeting of the German Anthropological society at Constanz, 24–26 Sept. 1877. This is by far the most instructive part of the number, and lets us glance at the immense activity of our German brethren.

The October number of *Revue d'Anthropologie* contains the following original papers: Note on a pre-historic tumulus in Buenos Ayres, by Estasnilao Ceballos; Study of the Soninkes (Senegal), by Dr. Bérenger-Feraud; The Skulls of the blacks of India (tribe of Maravars), by E. Callamand; Note on the Bahnars (Cochin China), by Dr. A. Morice. The most valuable part of the number is that occupied by the description of the "International Congress of Anthropological Sciences; The following are given in full: Opening address, by Dr. Paul Broca; Report of anthropological societies, by M. Thulié; Report on general anthropology, by P. Topinard; Reports on ethnology, by MM. Girard de Rialle and Bordier; Reports on palæontology, by MM. G. de Mortillet, E. Cartaillac and E. Chautre; Report on demography, by M. Chervin.

The Société Impériale des Amis des Sciences Naturelles

d'Anthropologie et d'Ethnographie de Moscow has not only taken an active part in the Universal Exposition, but has also published a pamphlet giving a brief sketch of the society and the work which it has done for the ethnology of the countries within Russian territory.

GEOGRAPHY AND TRAVELS.[1]

UNKNOWN AFRICA.—M. H. Duveyrier has recently read a learned paper before the Paris Geographical Society in which he divides the unexplored portions of Africa into six great regions. These regions are: 1. The Sahara and the Libyan Desert, measuring 5,750,000 square kilometres, and notwithstanding its desolate aspect containing in its ancient populations and rich oases much of great interest. 2. In the west the country between the Joliba and the coast of Guinea, covering the surface of 1,200,000 square kilometres. 3. In the center north of the equator the upper courses and the sources of the Benué and the Shari composing an area of 800,000 square kilometres in which to seek to complete our knowledge of the basins of the Nile and the Shari, and to discover the sources of the latter and those of the Benué. 4. In the southern equatorial zone adjacent to the preceding and embracing the head waters of the Nile, the sources of the Ogowé and the basin of the Congo, extending over 2,000,000 square kilometres, some of the greatest problems of African geography remain to be decided. 5. In the south the basin of the Cunene and the districts about Angola and Benguela. 6. Finally, in the east, the region which forms a triangle culminating in Cape Gardafui whose interior is totally unexplored, and presents subjects of investigation not only geographical, but also historical of the highest interest.

Adding together the areas of these six great lacunæ, we find they amount to upwards of 11,000,000 square kilometres—more than one-third of the African continent. But there is no reason to be discouraged at this large figure. Since the beginning of the present century the exploration of Africa has progressed at a mean rate of 234,285 square kilometres per year, and if it goes on at this rate, the whole of the African interior ought to be known in less than forty-eight years. But this calculation takes no account of the geometric progression of the figure of these discoveries which now produce in one year more than in the first twenty years of the century.

AFRICAN EXPLORATION.—Dr. Gerhard Rohlfs arrived at Tripolis on the 24th of October last. He expects to proceed early in December to Kufrah and thence to Wadai. He will then endeavor to trace the rivers Shari and Benué to their sources, and to explore the region intervening between them and the rivers

[1] Edited by ELLIS H. YARNALL, Philadelphia.

Ogowé and Congo. He is accompanied by a zoölogist, Dr. Stecker. The German African Association has granted him $7,500, and the German Emperor has entrusted him with valuable presents for the ruler of Wadai, in recognition of the kindness shown Dr. Nachtigal.

M. Paul Solleilet, who endeavored a few years ago to open up a commercial route between Algiers and Senegal, started from Bordeaux in the early part of 1878, on a second expedition with the same object for Saint Louis in Senegal. From there he proceeded to Backel, 250 leagues from the mouth of the Senegal river. Leaving there on the 8th of June, he arrived at Kuniakaro on the 23d of that month. When last heard from he was on the point of starting for Sego on the Niger. He proposes to winter in that town, and descend the river as far as Timbuktu in the ensuing spring. From thence he hopes to go to In-Salah and from thence to Algiers.

The feasibility of connecting the depression of the Shot-el-Jerid with the Mediterranean, and thus flooding the Algerian Sahara, is being investigated by Capt. Roudaire at the expense of the French Minister of Education. He has with him Dr. André who will examine into the natural history of the country.

The Portugese African Expedition, under Major Serpa Pinto, left Benguela on November 12, 1877, for Bihé, and reached the latter place in the following March. From particulars gathered by the *Academy* from Lisbon journals, we learn that they found the porter-difficulty even greater on the west than on the east coast, because as a rule the natives are only willing to engage for short journeys and specific destinations. At Bihé the explorers resolved to separate into two parties; Messrs. Capello and Ivens starting in a northern direction, whilst Major Serpa Pinto, on May 18, 1878, was on the eve of departing for the Upper Zambesi, intending to reach Zumbo early next year. This journey is likely to be very difficult, owing to the small escort and limited amount of goods taken and the hostile character of the tribes to be encountered. He proposes first to explore the region between the Cubango and the Zambesi. The geographical and meteorological observations already obtained are said to be very interesting. The Cubango has its source at a great distance west of Bihé, near that of the Cunene at Bailundo. The streams flowing to the west directly to the sea, or north into the Quanza, or south into the Cunene, have their sources in the vast marshy depressions of the country, between 12° 30′ and 13° S. latitude.

A successful experiment in the introduction of trained elephants from India into Africa has been made this year by Col. Gordon in Egypt. The elephants were first taken to Khartum and thence marched to Duffli, where they were employed in carrying all kinds of heavy goods. During their march they swam across the Nile three times. A portion of their journey from the

Sobat to Bahr was over territory never before traversed. The negroes along the line of march were frightened by them and made no attempt to attack the party. The elephants have gradually learned to live on leaves and grass as the wild elephants do, and keep in first rate condition. Col. Gordon consequently advises travelers to the interior from Zanzibar to use elephants, and thus avoid the necessity for a host of porters—a never ending source of delay and annoyance.

The Abbé Debaize, for whose scientific mission to Central Africa the French Government has apportioned a sum of 100,000 francs, reached Zanzibar early in June of last year. After the inevitable delay in obtaining porters and supplies, he started at the head of a caravan of 400 persons from Kikoka near Bagamoyo, on August 6th, and was last heard from at Mpwapwa, on September 1st. He has a good knowledge of Arabic, Coptic and of some East African languages, and has recently received instructions in Natural History from Milne-Edwards and from Capt. Mouchez, of the Paris Observatory, for astronomical observation.

The Belgian East African Expedition sent out under the auspices of the International African Association, at Brussels, after very great delay and several changes in its corps (caused by the death of two and the resignation of other members), and now conducted by M. M. Cambier, Wantier and Dutrieux, set out from Bagamoyo on July 4th. The Expedition included probably over 500 natives, of whom, however, 325 soon deserted with a large quantity of valuable goods. Leaving his companions to obtain other porters in place of the deserters, M. Cambier pushed on by a route half way between those of Mr. Stanley and Mr. Price to Mpwapwa. On August 13th, he started for Urambo in Unyamwesi where he contemplates founding the first of the "*stations hospitalières et scientifiques.*" Dr. Dutrieux had reached Mpwapwa on August 26th.

Ten Catholic Missionaries from Algeria also departed from Bagamoyo, on June 16th, 1878, and arriving at Mpwapwa on July 27th, separated—one party going to the Victoria Nyanza and the remainder to Ujiji. These missionaries have been practiced in the use of scientific instruments.

The *Academy* states that the London Missionary Society has heard of the arrival of its Tanganyika mission party at Ujiji. The march from Urambo, the capital of Unyamwesi, occupied but eighteen days, and the news "reached London in the short space of seventy-eight days, of which forty-five only were required for the transmission of the letter from Ujiji to Zanzibar, a distance of some 650 miles, and yet but eight years ago Dr. Livingstone was looked upon as lost, though he was residing at the former place."

Mr. Keith Johnston, the leader of the expedition which the Committee of the African Exploration Fund are about to dispatch

from the east coast of Africa to Lake Nyassa,[1] left England for Zanzibar on the 14th of November last. *Nature* states that his second in command, Mr. Thomson, has had an excellent training as a geologist, and it is expected that he will make important contributions to our knowledge of the geology of the region to be visited.

Sir Fowell Buxton stated, at a recent meeting of the Royal Geographical Society, that during the last year forty miles of the road from Dar-es-Salaam to the north end of the Nyassa have been made. The natives give no trouble and gladly use the road, but continue to walk in Indian file, so that the rapid growth of vegetation is but little impeded. One of the missionaries at Livingstonia, Lake Nyassa, departed, in June, 1878, on a journey through a portion of the country west of the lake.

The mission sent out by the Church Missionary Society to the Victoria Nyanza and Uganda has not been abandoned, although of the four who reached the lake in 1877, one, Dr. Smith, died of disease, and Lieut. Smith and Mr. O'Neil were murdered. The Rev. C. T. Wilson was at King Mtesa's capital, Rubaga, in Uganda, when the news of the massacre of his companions reached him, when he crossed the lake to Speke's Bay and made his way to Unyanyembe. The Society, however, has at least fourteen agents in the field, some of whom are carpenters, mechanics and agriculturists, and expect to have a chain of mission stations between Speke's Bay and Zanzibar. Mr. Wilson returned to Uganda in January, 1878, and up to the date of his last letter (May 9, 1878), was living comfortably at Rubaga, where he awaits the arrival of three colleagues sent out by the Nile route. From letters quoted in the *Academy* we learn that he has been favorably impressed with the quickness and skill in imitation of the Waganda. In his opinion they deserve the title of "the Chinese in Africa." They excel in basket making and in working in iron, copper and brass. They also dress skins beautifully. He also writes that the north-west corner of the Victoria Nyanza is thickly dotted with islands, some of which are fifteen miles long. The people say there are four hundred of them, and he has himself seen fifty or sixty. They are all called "Sasse" or "Sesse Islands," which may be translated "Isles of the Fishermen." These islands by dead reckoning extend to about S. lat. 0° 40′. In the winter and spring of 1877 the Nyanza slowly rose until the middle of May, when the maximum of two feet above the ordinary level was reached, and it then began to recede. In January, 1878, however, the water was within an inch or an inch and a half of its maximum in the previous May. The *Academy* remarks that in 1878, there was "a good Nile," which was not the case in 1877.

The Church Missionary Society, the *Academy* also states, has decided to despatch an expedition to the south-western end of the

[1] See AMERICAN NATURALIST for November, 1878, page 763.

Albert Nyanza, and in Dr. Behm's *Monatsbericht* in the October *Mittheilungen*, it is announced that the Swedish Mission Society, assisted by a wealthy English gentleman, proposes also to establish a station at Fatiko, northeast of the lake. The latest explorations have considerably reduced the dimensions of the Albert Nyanza. Romolo Gessi placed its southern limit at 0° 50′ N. lat. Stanley discovered the Beatrice Gulf at about 0° 25′ N. lat., and believes it to be a portion of a hitherto unknown body of water—the Muta Nzige, and not connected with the Albert. Col. Mason Bey, who last circumnavigated the Albert Lake, shows that its shape is different, and its dimensions even smaller than were supposed by Gessi. His compass survey was checked by four astronomical observations. The lake is rectangular, not elliptical, in shape, and Mason Bey places its southern limit at N. lat. 1° 10′. Both Gessi and Mason Bey agree that no large river discharges itself into the lake at its southern extremity, nor is there any communication with any other large lake. The *Athenæum* notices some views put forth on the subject by an Italian geographer, who suggests that the Albert Nyanza is simply a back water or reservoir of the Murchison or Victoria Nile, which would account for the varying dimensions of the lake. The *Athenæum* also doubts if the supposed isolation of the Tanganyika from the basin of the Albert is yet satisfactorily proved.

Summary of the Field Work of the United States Geological and Geographical Survey of the Territories, under Prof. F. V. Hayden, during the season of 1878.—During the past season the work of the United States Geological and Geographical Survey, under the direction of Prof. F. V. Hayden, was continued northward into portions of Wyoming and Montana Territories. The usual appropriation for the survey was not passed by Congress until July, rendering the field season very short, yet the results were of considerable magnitude and of much importance.

The survey proper was divided into four parties, one of which was devoted to the extension of the primary triangulation to the northward, two were engaged in topographic and geologic work, and the fourth performed photographic and special geologic duty. All the parties left the Union Pacific Railroad from Point of Rocks and Green River Stations about July 25, and proceeded northward toward the Yellowstone National Park. To the second division was assigned the duty of making an exhaustive survey of the park and its surroundings, and to the third the exploration of the Wind River range and the Snake River country. The primary triangulation was extended over about twelve thousand square miles. Eight primary stations were occupied, among them Wind River, Fremont's and Grand Teton Peaks, which are among the most difficult and hazardous of ascent on the continent. This division would have performed double this amount of work had

a band of hostile Indians not robbed it of its entire outfit about the middle of the season.

The second division made a very detailed survey of the National Park, securing the materials for the preparation of a topographical and geographical map on a scale of one mile to one inch. The geologist not only studied the geology minutely, but also sketched every square mile of the area. An unusually interesting and valuable collection of volcanic rocks and hot-spring specimens was obtained. The entire collection of the survey, which are of a varied character, will amount to about three tons weight.

The third division explored with equal care the Wind River and Teton ranges of mountains, a region of which comparatively little was previously known. The peak named by the survey Fremont's Peak was found to be over 14,000 feet in height above the sea, with no trace that any human being had ever previously reached its summit. Three complete glaciers were discovered on the east side of the Wind River Mountains, the first ever known to exist east of the Pacific coast. The old glaciated rocks and morainal deposits were found on a remarkably grand scale in both the Wind River and Teton ranges.

The object of again surveying the Yellowstone Park was to bring it under the system of triangulation which had been employed with so much success in Colorado and to make the entire work uniform. All the old hot-spring basins were resurveyed in great detail, and several new ones were discovered and mapped. Soundings and temperatures of several thousand hot springs were taken. The history and habits of the geysers were carefully studied. The photographer of the survey obtained over fifty fine views of the bowls and other curious ornamental details of the Hot Springs.

The results of the season's labors, though a short one, have been on the whole very satisfactory. About 12,000 square miles of very difficult country were surveyed, much of it in minute detail, and a mass of observation secured for the twelfth annual report, which will make it of more general interest and value than any of the preceding.

The district assigned to this survey by this department for the next Atlas comprises all the area of the Territories of the United States north of latitude 41° 45′, east of meridian 117° and west of meridian 94°. It is estimated that the mapping of this area will occupy five years more, and when this is completed, the survey will have mapped over one-fourth the territory of the United States west of the one hundredth meridian.

GEOGRAPHICAL NEWS.—Petermann's *Mittheilungen* will be continued and conducted by Dr. E. Behm, who has been long connected with Justus Perthes Establishment, is one of the editors of the well-known *Bevölkerung der Erde*, and is the author of the

excellent monthly summaries of geographical news in this most important of geographical journals. Besides others, the number for November contains an article on the use of elephants in African exploration, written by Dr. Petermann shortly before his death, and one concerning D'Alberti's New Guinea Exploration, with a map of the Fly River.——The *Geographical Magazine* for November contains the best map of the seat of war in Afghanistan which has yet appeared, both as regards accuracy, fullness of information and excellence in the mechanical execution. With the December number this periodical ceased to be published, but is replaced by the *Proceedings of the Royal Geographical Society and Monthly Geographical Record*, under the charge of the Secretary of the Society, Mr. Clements R. Markham, who so ably conducted the magazine.——Several new geographical monthly periodicals have recently appeared in Europe. The *Deutsche Rundschau für Geographie und Statistik* is edited by Prof. Arendts, of Munich, and published by Hartleben, Vienna. *Aus fernen Zonen*, published by Mutze, Leipzig, is especially intended for the reception of communications from members of the various Christian missions in the less known portions of the globe; whilst from Paris the *Annales de l'Extrême Orient*, edited by Count Meyners d'Estrey, of the Indian press, expects to keep the scientific world informed of literary and geographical progress in Southern Asia, and especially in the Dutch Indies and in Dutch Oriental literature.——Dr. Nachtigal, the distinguished African traveler, has been elected President of the Berlin Geographical Society.——The *Athenæum* states that Mr. Johnson, the present Governor of Ladakh, when connected with the Indian Survey of 1865, ascended Peak K. 61 of the Kuen Lun range, whose height it now appears is no less than 23,890 feet! This is believed to be the greatest height above the level of the sea attained by any traveler on foot. The plains at the base of the Peak have probably an altitude of nearly 18,000 feet.

MICROSCOPY.[1]

Removal of Air from Microscopic Specimens.—Much difficulty has been experienced by the working microscopist in removing air from his specimens. If he wishes to mount wood-sections the difficulty is increased. Some may suppose that such an undertaking is physically impossible; for hitherto, in spite of all the pains and labor taken, unless by some lucky stroke, as it were, bubbles of air will still be left in the objects, and the slide becomes entirely worthless as a perfect specimen.

Various methods have been adopted to remove these bubbles of air, with greater or less success. One method has been to soak the specimens, after they have been cut, in different fluids for some length of time. The favorite fluids have been turpen-

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

tine, oil of cloves and the like; these, however, give very unsatisfactory results. My friend, Dr. C. B. Johnson, of Providence, R. I., informs me that he has sections of wood which have been laying in oil of cloves for over three years, and from which the bubbles of air have not been at all removed. Perhaps the same may be said of the oleo-resins. Recourse has also been had to the air-pump; the idea being that an object placed beneath the bell glass, a few strokes of the piston will suck out all the air from it. But although in theory this seems plausible enough, yet as a perfect vacuum cannot be attained, some air, be it ever so small an amount, must render the objects of no use for microscopic examinations.

Thus have microscopists been at their wits' end to discover some process by which their object can be perfectly and satisfactorily accomplished. As no notice has been made of late of any new procedure in this direction, I think my friend, Dr. Johnson, who has had great success in mounting objects for the microscope, can justly be entitled to the first discovery of a mode for the removal of air, at once simple and effective. The apparatus he employs is of very simple construction, being a digester, or, as in his case, a common dentists' vulcanizer, the means—steam. The specimens to be thus treated, especially those of wood, are prepared in the usual way, and made ready for mounting. They are next placed in a small vessel of any material which will resist a certain amount of heat. Dr. Johnson uses a small glass phial in his experiments; this is filled up with water after all the specimens, as many as it can conveniently hold, are placed within. A cork can be used, but a slit must be cut in it to allow the escape of air and the admission of steam and hot water. A little water is now poured into the vulcanizer, the bottle of objects placed within and the lid of the machine screwed air tight. The whole is now heated to a temperature of about 300° Fahr. for a few minutes. This temperature is sufficient for all practical purposes; a higher degree of heat is unnecessary, or a longer time to remain at the given temperature needless.

When sufficiently cooled the phial is removed, the water drained from the bottle and alcohol substituted. The specimens are now ready for mounting, or can be bottled and set away indefinitely for use.

This constitutes the whole process; by it the specimens are *absolutely free* from air. Perfect satisfaction is guaranteed; and in every case we are absolutely sure of the results, provided of course that the proper care has been taken.

The *modus operandi* seems to be that the steam penetrates the pores of the wood or other substances, and forces out the air whose place it takes. The air is then absorbed by or dissolved in the surrounding medium. The woody fibres are not destroyed by the hot and compressed steam, except the soft tissues, as one would at first

sight suppose. They are entirely uninjured, and their purposes for microscopic study remain as good as by any other process. Tender specimens in every case must be tenderly treated. This mode of procedure has been followed by several microscopic friends in my vicinity for two or three years, and all the specimens so treated have been remarked for their beauty and excellence.—*F. C. Clark, Providence R. I.*

Limits of Accuracy in Measurements with the Microscope.—Before we can safely draw conclusions from a given series of measurements, it is necessary to know within what limits their errors can be determined. A simple and direct way to do this is to compare the measurements of the same space made by different observers and under entirely different conditions. I may get results which show an agreement, *inter se*, quite within the limits of the accuracy required, and which are yet wide of the truth. But if another observer obtains substantially the same results from a series of measurements made under entirely different conditions, the inference of their general correctness may be drawn with tolerable safety.

One must draw a sharp distinction between absolute accuracy and an appearance of accuracy. For example, the head of the screw of my dividing engine can be set to correspond to a motion of one billionth of an inch with entire certainty as far as the mechanical indications of this degree of accuracy are concerned, and yet previous to May, 1877, the actual errors of a given ruled plate amounted under certain conditions to $\frac{1}{7000}$ of an inch. Even now, after four epochs of improvement, I can hardly say of a given space that it is certainly true within $\frac{1}{80000}$ of an inch, until I have made a special investigation of it with my comparator.

In carrying forward this investigation I was fortunate in securing the coöperation of Prof. Edward W. Morley, of Hudson, Ohio, an observer who possesses in a high degree the three requisites, patience, care and skill. I ruled five plates of bands, plates No. 1 and No. 2, having spaces of $\frac{1}{600}$ and $\frac{1}{480}$ of an inch, respectively. These plates were ruled just as, I regret to say, all plates were ruled previous to May, 1877, without any attempt to correct the errors peculiar to the screw and its mounting. For four years previous to this date every effort was made to correct these errors by mechanical adjustments. After this date I deliberately abandoned all attempts to do this. Instead, I resolved to admit the existence of these errors, and after determining their value, I adopted a device for correcting them during the process of ruling. Plate No. 3 was ruled like No. 1, but with these systematic corrections applied. My next improvement consists in adopting a device for correcting not merely the systematic errors depending on one revolution of the screw, but also the errors peculiar to particular parts of the screw. Plate No. 4 consists of 101 lines separated by an interval of $\frac{1}{2400}$ of an inch, and freed as nearly as

possible from errors of all kinds. Plate No. 5 consists of 21 lines separated by an interval of $\frac{1}{20}$ mm. After careful measurement with two different micrometers and two comparators, the plates were sent to Prof. Morley, the details of whose measurements will be found in the forthcoming volume of the Proceedings of the American Academy of Arts and Sciences. The degree of agreement between his results and my own is much more perfect than I had anticipated before beginning this investigation.

From this investigation I think we may safely draw the following conclusions: (*a.*) Two equally skillful observers can measure the same space within about $\frac{1}{3000}$ of an inch if the space does not exceed $\frac{1}{50}$ of an inch. For a space of $\frac{1}{100}$ of an inch the deviation will probably amount to $\frac{1}{8000}$ of an inch in case the measurements are made with an eye piece or a filar micrometer. (*b*). The average deviation for accumulated errors under similar conditions is not far from $\frac{1}{5000}$ of an inch for eleven intervals. For a larger number of intervals the deviation will be somewhat larger, but it will not be in proportion to the number of intervals. (*c*). A single observer can obtain an agreement with a normal equation representing all the observed values as far as a solution by least squares can represent them, within somewhat smaller limits than those obtained by comparing the results obtained by two different observers.—*Wm. A. Rogers, Harvard College Observatory. (From a paper read at the National Microscopical Congress, August,* 1878.

The Society Screw.—At a recent meeting of the State Microscopical Society of Illinois, Mr. Bulloch urged the desirability of adopting a uniform objective screw of larger size than the society screw now in use, as being essential to the efficiency of low power lenses of high angle. That the society screw, which has now become an almost indispensable convenience, is too small to admit of efficient work from these lenses, is a conceded fact, and some makers in this country who make low powers of enormous angle have already adopted special screws for them. The uniformity urged by Mr. Bulloch is greatly to be desired, and could be easily attained if its importance were appreciated in time.

Exchanges.—Gatherings containing polycystina, etc., wanted in exchange. Address I. F. Stidham, Columbus, Ohio.

Western mosses, etc., for other species. George W. Worcester, West Side, Crawford Co., Ohio.

Diatomaceous earths and named diatoms for named diatoms or other good mounted objects. M. A. Booth, Longmeadow, Mass.

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SCIENTIFIC NEWS.

— The United States Entomological Commission, attached to the United States Geological and Geographical Survey of the

Territories, has issued its first report on the Rocky Mountain locust, or destructive grasshopper of the West, a volume of 700 pages, fully illustrated with maps, plates, and woodcuts.

The favorable predictions made by the commission last winter had an encouraging effect, and stimulated the immigration to the country of late years ravaged by locusts. The statement which a full survey of the field enabled the commission to make in advance, viz: that there would be no serious injury in 1878, has been fully verified. The commissioners have continued their labors during the past summer, confining their attention to that northwestern portion of the country which they have designated as the Permanent Region, the object being to gather further knowledge of that region, with a view of preventing the ravages of the Rocky Mountain locust therein and its migration therefrom.

The problem of destroying the young insects as they hatch out in the more fertile country in the agricultural regions of the West, is virtually solved in the report which the commission has already issued, and the task which they now undertake is to endeavor to prevent the migration of the winged insects from the Permanent Region into the more thickly settled country.

An appropriation of $25,000 was asked of the last Congress for the completion of the work mapped out, and $10,000 were appropriated, and this only toward the end of the fiscal year. The commissioners ask for an additional sum of $15,000, in order that they may be able to continue their investigation until the practical work is accomplished. It was too late in the season when the last appropriation was obtained to permit the completion of the work this year, but with such means as they have husbanded, added to the additional appropriation asked for, and with promised assistance by the Dominion authorities, they will be enabled, by getting into the field early the coming spring, to complete fully the work assigned to them.—*From the Report of the Secretary of the Interior for* 1878.

— A report of the Chesapeake Zoölogical Laboratory for the last summer appears in the Third Annual Report of the John Hopkins University, Baltimore. This laboratory was established by Prof. W. K. Brooks for the higher instruction of the students of the University and others in zoölogy. It was opened at Fort Wool, June 24, 1878, and closed Aug. 19th. Some excellent work was accomplished, notwithstanding the lack of the large marine animals. Enough was accomplished, we should judge, to warrant the authorities of the University in maintaining the school and rendering attendance upon it a necessary part of the biological course.

We notice that the following papers in biology were read at the meetings of the Scientific Association of the John Hopkins University: On the early stages in the development of Gastropods,

by W. K. Brooks; A review on the expenditure of energy by working muscle, by H. N. Martin; On the formation of the female pelvis, by C. Sihler; On the influence of stimulation of the optic lobes upon the respiratory center of the frog, by H. N. Martin; Contributions towards a history of the Maryland Cambari, by P. R. Uhler; The Urodela of North America, by S. F. Clark.

— The work of the United States Fish Commission was carried on with an unusual degree of success at Gloucester, Mass., during the past summer. The steamer *Speedwell* made her last trip September 26th, having been used almost daily in dredging trips since the middle of July. Prof. Baird, the commissioner, was assisted by Professor Verrill, Mr. Richard Rathbun and Mr. Sanderson Smith, who paid special attention to the marine invertebrates; Prof. Farlow studied the algæ, Prof. Goode, Dr. Bean and Mr. Earle attended to the fishes, while Mr. Asaph Hall, Jr., had charge of the temperature observations. A good many new fishes, corals and other invertebrates were collected, while much that is new regarding food-fishes and fisheries was discovered. The energy and success of the manifold operations of this important Commission are most apparent.

— A goose belonging to a Gloucester, Mass., family died last week at the advanced age of 70 years. They have another still living that is known to be 50 years of age.

We have not endeavored to substantiate this statement, but copy it from the daily papers. Geese of this age certainly deserve an obituary notice. Can any one give us authentic statements regarding the extreme old age of fowl and quadrupeds?

— We learn from Mr. S. H. Scudder that a hymenopterous insect (Myrmar) very slightly larger than *Pteratomus pitnamii*, being very slightly over one-ninetieth of an inch long, has been found in amber, according to Duisberg's Zur Bernstein Fauna (Schriften K. Phys. Okonomische Gesellschaft zu Königsberg. Band 9, p. 23). These two insects are members of the same family (*Proctotrupidæ*) and are the smallest insects yet known.

— B Westermann & Co. send us the title of an important work whose publication has just begun, viz: Buctecker's Systema Entomologiæ sistens Insectorum Classes, Genera, Species. Pars I. Odonata (Fabric.) Europ. 42 tabulæ, photograph. floridisque coloribus distinctæ. Colored $27.50, plain $13.20 This work will be published in fifteen volumes, and its continuation is secured, the MS. being all ready.

— We have been repeatedly asked what is the figure on the first page of the cover of this magazine. It is copied from a figure in Haeckel's great work on Radiolaria, of his *Eucyrtidium cran-*

oides. The bell-shaped shell is perforated by numerous holes, out of which stream in all directions the pseudopodia, some of which are enlarged at intervals into small masses of protoplasm.

— The death has recently been announced of Sir Richard John Griffith, Bart., the geologist and engineer, who died in Dublin, aged 94 years; of Thomas Belt, an English mining engineer and geologist, well known from his "Naturalist in Nicaragua," who died at Denver, Colorado, Sept. 22d; and of Prof. Robert Harkness, who died Oct. 3d, at Dublin.

— Subscriptions are solicited for a Manual of Conchology; structural and systematic, with illustrations of the species, by George W. Tryon, Jr., conservator of conchological section of the Academy of Natural Sciences, of Philadelphia. Vol. i, Cephalopoda, will be published by the author at Philadelphia, during the the coming year.

— The schooner *Florence*, of the Howgate Arctic Expedition, which returned at the close of October, Congress having failed to appropriate money for Polar colonization, brought home valuable collections of specimens and drawings, made by Mr. Kumlein, the naturalist of the expedition.

— Under the name of *Science News*, Mr. S. E. Cassino, of Salem, Mass., publishes an octavo fortnightly magazine of sixteen pages, edited by Messrs. Ernest Ingersoll and W. C. Wyckoff. It is devoted to general science, physical as well as natural.

Dr. Kalter, the editor of the *Entomologische Nachrichten*, published fortnightly at Putbus a Rûgen, Germany, desires copies of papers and articles by North American entomologists for notice in his periodical.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, Nov. 5, 1878.—Thos. Meehan and others remarked upon the indigenous character of *Calluna vulgaris.*

Nov. 12.—Dr. Jos. Leidy made some remarks on the distribution of *Chenopodium*; he also described some parasites of *Donax fossor*, one of which he named *Distomum cornutifrons.* Meehan remarked on *Mitchella repens.* Dr. A. J. Parker made some remarks on the comparative development of the Island of Reil in the brains of Primates.

Nov. 19.—Messrs. Gray, Redfield and Meehan spoke on the evidence in favor of the indigenous character of *Calluna vulgaris.* Drs. Leidy and Evarts made observations upon Gordius, the former gentleman describing a new species parasitic in *Clepsine* which he called *G. tenuis.*

Dec. 3.—Dr. Leidy made some remarks on the rarity of *Taenia*

solium, and the commoner occurrence of *T. mediocanellata*, with some account of the specific differences which he had observed.

Proceedings of the Sections of the Academy:—Microscopical and Biological, Nov. 4.—Mr. J. A. Ryder remarked "On the Gemmule vs. the Plastidule as the Ultimate Physical Unit of Living Matter."

Nov. 18.—Dr. J. G. Hunt, on the classification of Fungi and the best modes for their microscopical study. Mr. Jos. Zentmayer exhibited a new mechanical revolving stage, which admitted of 70° of obliquity of illumination.

Dec. 2.—Dr. H. C. McCook made a communication "On the minute anatomy of the stinging organs of ants."

Boston Society of Natural History, Nov. 20.—Dr. David Hunt make a communication entitled Darwinism and the Human Eye; Dr. C. S. Minot remarked on growth as a function of cells.

Dec. 4.—Dr. S. Kneeland remarked on traces of the Mediterranean nations in the Northern Ocean. Mr. S. H. Scudder read a paper on early types of insects, or the origin and succession of insect life in palæozoic times.

American Geographical Society, Dec. 12.—Mr. James Douglas, Jr., gave an account of his journey along the West Coast of South America from Panama to Valparaiso.

Appalachian Mountain Club.—Prof. H. F. Walling gave some account of Mt. Toby, Mass., and Mr. W. H. Pickering described an ascent of the Half Dome, Yosemite.

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SELECTED ARTICLES IN SCIENTIFIC JOURNALS.

American Journal of Science and Arts.—December, 1878. Valley of the Minnesota river and of the Mississippi river to the junction of the Ohio: its origin considered, by G. K. Warren (with eight plates). On some points in lithology, J. D. Dana. Anatomical peculiarity by which crania of the Mound-builders may be distinguished from those of the modern Indians, by W. J. McGee. Discoveries in western caves, by H. C. Hovey.

Siebold and Kolliker's Zeitschrift für wissenschaftliche Zoologie.—November 11. On the convolutions of the brain of the Ungulates, by J. Krug. Contributions to the anatomy of the Ophiurans, by Prof. H. Ludwig. On some cases of parasitism in the Infusoria, by J. Van Rees. On the developmental history of the fresh-water mussels, by C. Schierholz.

Annales des Sciences Naturelles.—August 5. Anatomical and physiological researches on respiration in the fishes, by M. Jobert. Experiments on the conditions of development of Ligulæ, by M. Deschamp.